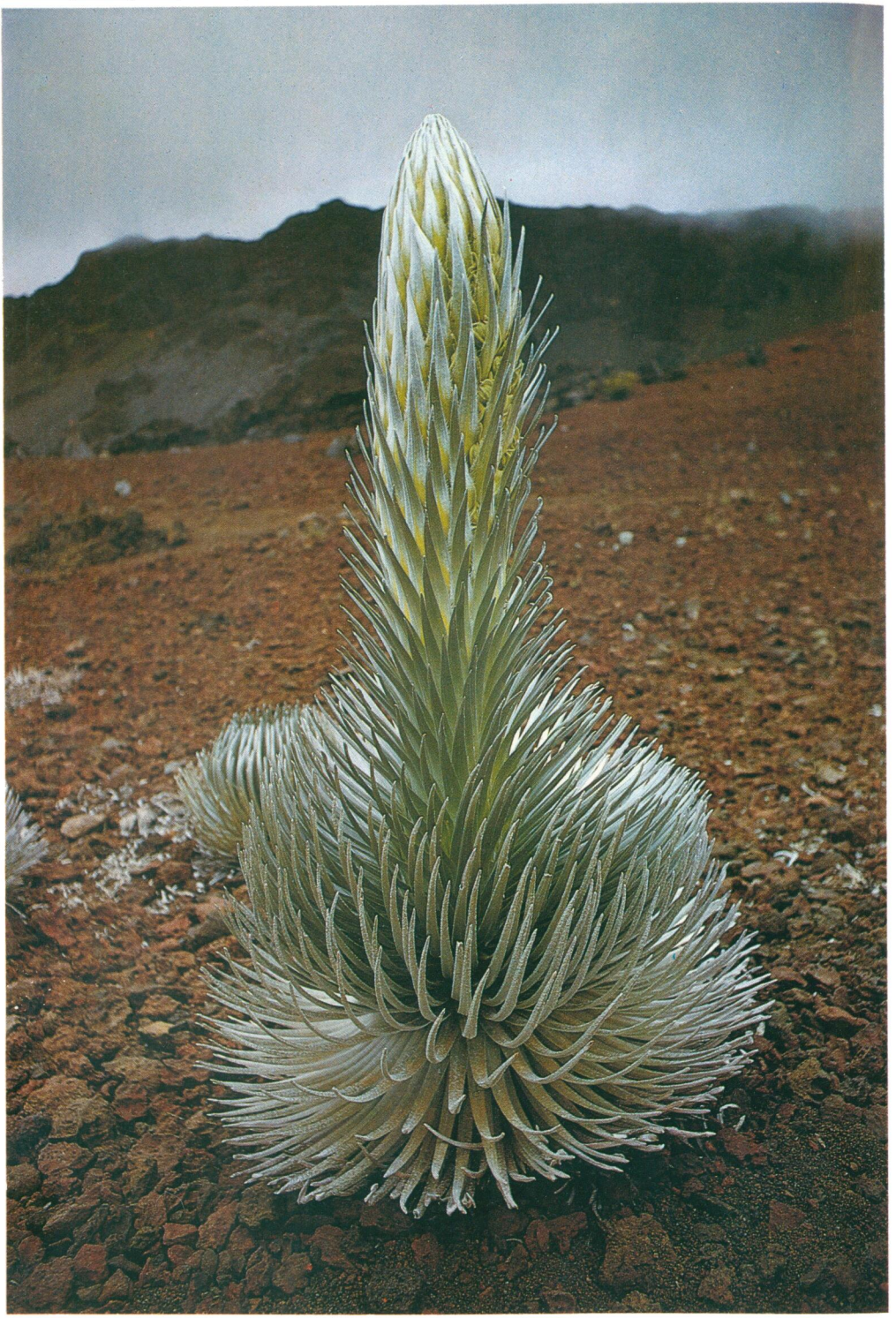
HAWAII'S VANISHING FLORA

By Bert Y. Kimura and Kenneth M. Nagata



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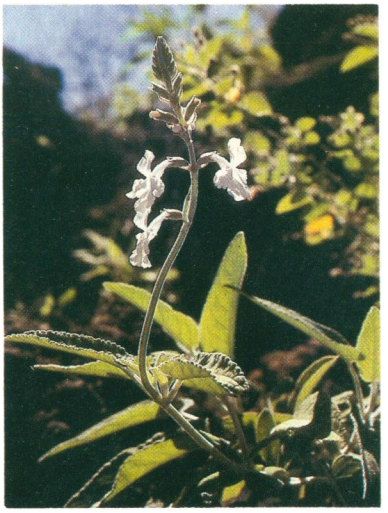

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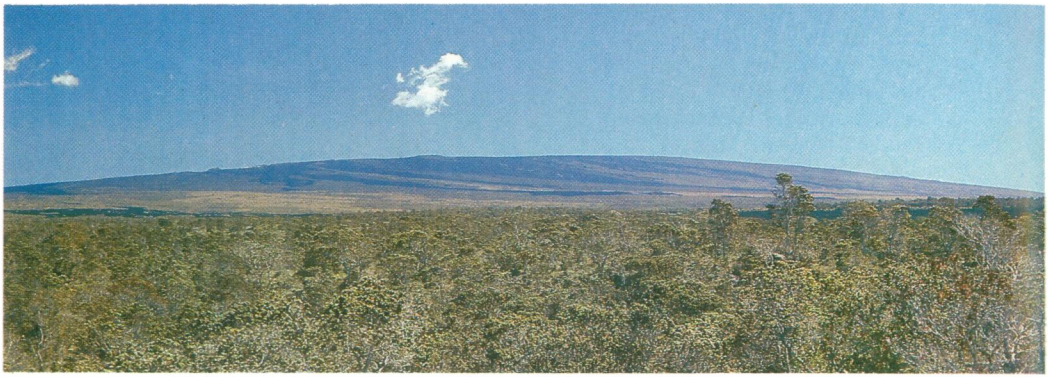
Stenogyne calaminthoides

PREFACE



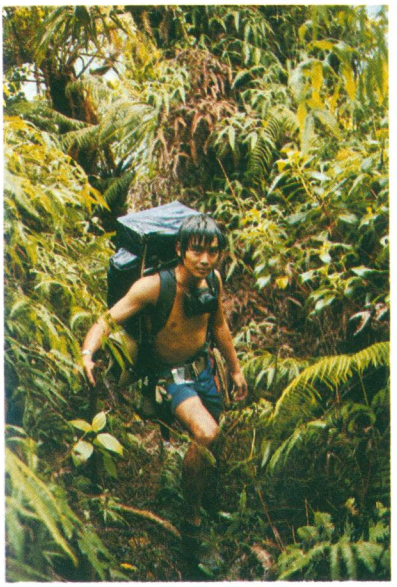
Mauna Loa, Hawai'i

Numerous popular articles have been written about rare plants and animals in Hawai'i. They usually appear in magazines, newspapers or texts and contain a wealth of information, often with impeccable photography. Several soft cover books have also served as excellent introductions to the Hawaii's plants.

To the average hiker or amateur naturalist, these popular texts have probably become an essential portion of their library. The serious observer, however, often craves for more substantial facts. We hope that these "semi-serious botanists" as well as beginners find this book helpful.

A number of plants can be found along public trails and may be easily observed but many are in extremely difficult and largely inaccessible areas. While hiking, it is always wise to keep on the established trail. Besides the treacherous terrain, excessive disturbance created by off-trail scrambling and sliding may destroy seedings and also create open areas where aggressive weeds can become established. Nothing is served by breaking branches. Respect the land you walk on and collect photographs, not plants.

It is not our intent to publicize exact localities for fear that increased visitation will create more stress upon the plants as well as the fragile environments in which they live. In the eastern United States, several trees of a rare species were actually cut down by the landowner because of the stream of curious visitors and scientists who constantly trespassed. Upon learning that his land was mentioned as part of the proposed habitat for an endangered species, another owner ravaged it before legislation



Hanu'u Pali, Wai-lau, Moloka'i

could be enacted to preserve the area. This enabled him to develop his property rather than having it earmarked as a plant reserve.

It is also not our intent to have these plants destroyed by over-collecting. State of Hawai'i Forestry Division regulations prohibit the taking of any plant or plant part without written permit. Yet there are many who would harvest the more attractive ones for profit. Others would collect the flowers and fruits off the last known plant just for the notoriety of having possibly the last specimen in their private herbarium. However, it is only through knowledge and understanding that anything can be saved. We feel the urgency to save our unique native Hawaiian flora from the wisdom and empathy gained through *aloha 'aina,* a love for the land of our birth.

Po'o-mau Canyon, Kaua'i

HOW TO USE THIS BOOK

The plants described in this book are organized by families in alphabetical order. Within each family, the plants are arranged alphabetically by their scientific names. Except when a more recent publication is available the nomenclature follows that of St. John (1973). To avoid confusion, scientific names are used for identification. Popular names are used when known and in some cases, several can be applied. An index of common names is available in the back of this book.

The scientific names of all plants and animals are in Latin and consist of at least two words. For instance, the scientific name for our *koa* trees is *Acacia koa. Acacia* is the genus, a group of very closely related plants with similar characteristics. There are about 500 species in the genus *Acacia.* The second word, *koa,* is the specific name for one particular plant of the genus. Often, the scientific name is followed by the name (frequently abbreviated) of the botanist who first validly named the plant. The American botanist Asa Gray decided that our Hawaiian koa was a new species of the genus *Acacia,* described its essential features and named it. Thus the name is sometimes written *Acacia koa* Gray.

Acacia koa, Kōke'e, Kaua'i

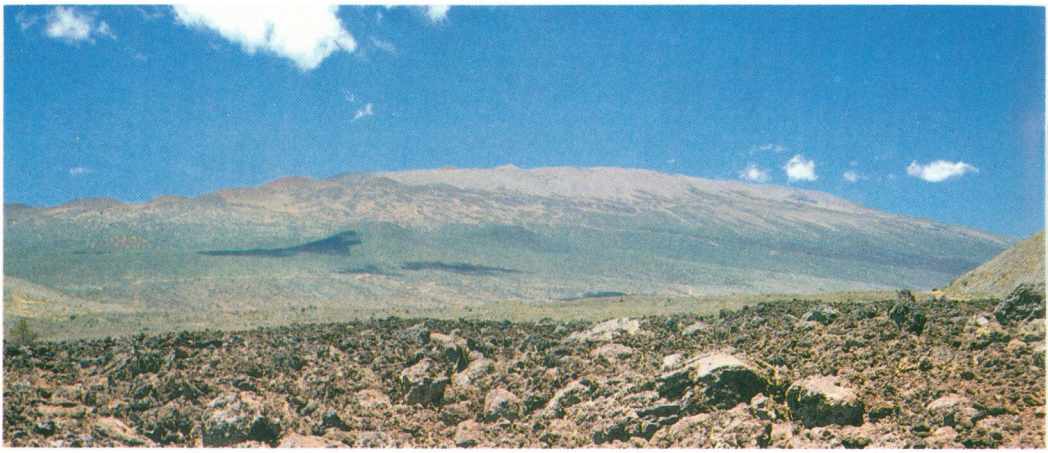
All of the plants described in this book are endemic to Hawai'i, (i.e., found naturally only in the islands of Hawai'i). Most are endemic to particular localities. A plant native (i.e., arrived without man's aid) to Hawai'i and to other areas is called indigenous. *Scaevola taccada,* the beach naupaka or naupaka-kahakai, is indigenous. All plants brought by man either before or after Captain James Cook's arrival, are non-native or exotic. The plants in this book are not only endemic but also rare and were considered by the Smithsonian Institution to be in immediate danger of extinction. All of these were proposed by the Federal Government for protection under the Endangered Species Act of 1973. Four of the five Hawaiian plants officially protected are illustrated.

Although several popular articles have been written on rare and endangered Hawaiian plants, information on specific plants is often not readily available. Plant descriptions are supplemented by field observations made by the authors and specific references are included to aid the more serious reader.

Cyanea superba, Pahole Gulch, O'ahu

Scaevola taccada, Mo'omomi, Moloka'i

INTRODUCTION



Mauna Kea from Pōhaku-loa, Hawai'i

Hawai'i is a great chain of 18 major volcanic islands, shoals, atolls and reefs in the oldest, broadest and deepest of all oceans. Stretching over 1500 miles, it is the most isolated island group in the world. The nearest continent lies 2400 miles away, the nearest group of atolls or low islands are 850 miles to the south and the nearest group of volcanic or high islands is more than 1000 miles away.

These isolated Hawaiian Islands are noted for their remarkably diverse ecological environments. There are very few regions in the world where several distinct environments exist on the same mountain mass. At the summit of Mauna Kea, a subpolar desert exists at 13,000 feet above sea level. The mean low temperature during the summer is near freezing. There are also lush tropical rainforests, hot arid lava fields, sandy beaches, rocky shorelines and coastal bluffs.

Isolation, genetic mutation and adaptive radiation, have resulted in a unique assemblage of organisms. When the Polynesians first arrived over a millennium ago, more than 99% of the insects and land mollusks were new to them. In other words, 99% of the native insects and land mollusks are endemic or not found outside Hawai'i. Almost 99% of the birds and 65% of the ferns are also endemic. Of the approximately 2200 native plants, nearly 97% are endemic. Some believe that the original flora of Hawai'i may have numbered as much as 50,000 species and varieties.

Thousands of foreign plants and animals have been introduced beginning with those brought by the original Hawaiian settlers. At least 5000 plants have been brought into Hawai'i. In many cases, these introductions have displaced the natives. With so many foreign introductions, we often lose sight of the compelling fact that fully 95% of all native terrestrial fauna are not found outside Hawai'i. Few of us are fortunate enough to see our only two native mammals–the bat and the monk seal. Few are able to recognize even one of our 3800 native insects. Only in Hawaii Volcanoes National Park can we readily observe native birds. Many have never seen nor will ever see a living native land shell. Why? Why, in this paradise of the Pacific are we ignorant of this portion of our heritage? Why are our native organisms so scarce today?

Isolation and evolution in the Hawaiian organisms resulted in a large number of species which adapted to the multitude of different environments. Competition between species was not fierce and many lost their aggressive tendencies. The few species that retained aggressive attributes include pioneer species that first inhabit a new lava flow or a landscar–*uluhe* (*Dicranopteris*), *'ohi'a-lehua (Metrosideros), koa* (*Acacia koa*), *'ama'u* (*Sadleria*), *naupaka* (*Scaevola*). Another change was the loss of seed dispersal mechanisms. Many of the Hawaiian *ko'oko'olau* (*Bidens*) have lost the barbs on their "needles" and unlike their relative, the Spanish needle (*B. pilosa),* they do not cling when brushed against. Thus many species are found only in certain localities partly because of this inability of long-range transportation. Similarly, in birds and insects, the inability to fly represents a loss of dispersability. An exceptionally high proportion of native insects are flightless. Restricted distributions, relatively small numbers of individuals and specialized requirements seem to be common in the Hawaiian biota.

Because there were no forest animals besides insects and birds, our native plants did not develop the traditional defenses against introduced herbivores: poisons, thorns, prickes, or scented oils. Hawaiian raspberries *('akala)* are thornless. Hawaiian mints *(Stenogyne, Haplostachys, Phyllostegia)* are mostly scentless. Hawaiian nettles *(māmaki, olonā, ōpuhe)* are harmless. In the absence of hooved animals, our plants developed fragile root systems.

High degrees of specialization and genetic weaknesses inherent in small populations are characteristic of our native organisms. They are vulnerable to even the slightest change in habitat. Extinction in such cases is easy.

When the Polynesians first settl-

Achatinella mustelina

ed in Hawai'i they brought useful plants and animals, many of which eventually became naturalized. Early Hawaiians cut down native vegetation in the lowlands and foothills to grow crops. Native plants were harvested for food, shelter, transportation, clothing and for making tools. Nobody knows, however, how many native organisms became extinct during the millennium before the second "discovery" by Captain James Cook. In the following 200 years, the *haole* or foreigner introduced more plants and animals. Forests were cut down for fuel and housing. Vast land areas were cleared for crops and subdivisions.

The discovery of sandalwood *('ili-ahi)* in Hawai'i brought about the first commercial exploitation of land. For about 25 years beginning in 1804, the sandalwood trade thrived, generating an annual income of as much as $400,000 in one year. Lacking the shrewdness and wisdom of Kamehameha I, the succeeding kings squandered this wealth on personal luxuries. By 1821 the Kingdom was in debt. The population was pressured by local chiefs to gather even more *'ili-ahi* but the supply steadily declined. In 1826, William Ellis reported an encounter in 'Ōla'a with a chief and 400 people carrying sandalwood. Five years later the trade had all but ended. This intensive harvesting had a measurable impact on the forest.

Aleurites moluccana (Kukui)

Land utilization by the early settlers and sandalwood harvesting left indelible marks on the Hawaiian landscape, but these were minor compared to the devastation wrought by introduced herbivores–cattle, goats, sheep, deer, and European pigs. Within 20 years of Cook's arrival, these animals were left by European explorers for replenishing food supplies during Pacific voyages. Having no natural predators in Hawai'i, the animals thrived, eating and trampling vegetation and upsetting the delicate ecological balance. Defenseless, our native vegetation was replaced by hardier, more aggressive introduced species. Entire forests and plant communities were destroyed by the animals. Many plant groups and birds which had evolved in the lowlands, foothills and easily accessible valleys were decimated. By the turn of this century, the number of feral animals in the forests was alarming. In the Big Island's forest reserves 257,028 animals were killed between 1922 and 1947.

In certain areas sheep, goats and pigs have been serious threats, but the introduction of cattle is

Auwahi, East Maui

considered the most catastrophic even in Hawaiian natural history. Cattle were brought to Hawai'i by George Vancouver in 1793 and 1794. Protected by Kamehameha I's *kapu,* wild cattle could not be shot without permission of the king. By the early 1800's, cattle had been brought to all the major islands and were allowed to run freely. By the mid-1800's ranching had become a major industry. Dense forests were being converted into barren landscapes. Near Waimea, Hawai'i where treeless plains now exist, the original verdant forests confused even local residents.

Serious damage to the forest was noted as early as 1815, but it was not until nearly a century later that concern for conservation prompted the establishment of forest reserves. By 1947, 26 forest reserves had been established containing 452,162 acres. Under the Territorial Board of Agriculture and Forestry's regulations, feral cattle were to be eliminated, but the sheer numbers of these animals made this an exceedingly slow task. Even today wild cattle can still be found in some areas.

Compared to the continental United States, our biota is marked by disproportionately large numbers of endangered and extinct organisms. A higher percentage of Hawaii's birds have become extinct than in any other region. Of our 67 endemic species, about 23

Upper Wai-ākea, Hawai'i

are believed to be extinct. Only 15 are not in apparent danger of extinction. All four of our endemic freshwater gobies or *'o'opu* and both of our endemic mammals are endangered. Not much is known of the present state of our insects and mollusks. Evolving on O'ahu, tree snails of the genus *Achatinella* once numbered 41 species. Today, at least 22 are believed to be extinct and 19 considered endangered. Nine of 10 species of another endemic snail, *Carelia,* are extinct.

In 1975, the Smithsonian Institution reported to Congress that 40% of the species and varieties of Hawaiian plants were endangered or extinct. The extinction rate of Hawaii's flora is alarming. At least 255 species are thought to be extinct. It has been estimated that one successful introduction per 90,000 years would account for the ancestral stock of Hawaii's native flora. Since our presence, plants have become extinct about once every nine months. As one pre-eminent botanist succinctly assessed the situation: ". . . there have been more animal and plant

species extinguished in the Hawaiian Islands than in the entirety of North America"

Endangered species and habitats epitomize the degradation of our environment. Endowed with a rich flora of approximately 20,000 taxa or plant groupings, the continental United States has experienced in the past bicentennial an unequaled economic growth rate. Unfortunately, this is reflected in the rate of extinction. Before tribal man's presence, about three species of birds and mammals became extinct every 100 years. However, since the settling of North America, the rate increased to 150 every 100 years. Today, an estimated 2,000 of the remaining flora is either threatened or in immediate danger. Although there are many reasons for the disappearance of a species, habitat alteration and destruction is by far the most significant.

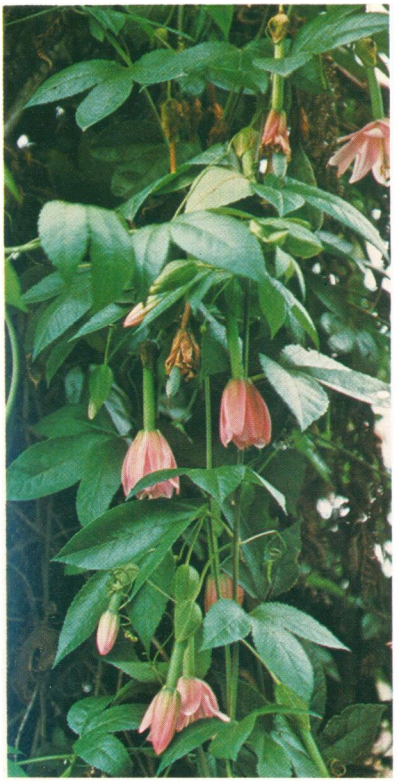
Hawai'i, with its limited land, presents a much more alarming situation. Population, economic, and recreational pressures are enormous. The basic philosophy of land management in Hawai'i has been one of multiple use. The same area is utilized as forest reserve and watershed as well as for hunting and hiking. Many believe that this is necessary. Their belief is vigorously opposed by others who feel that certain forestry practices and the existence

Stenogyne kamehamehae

Pu'u-maka'ala, Hawai'i

of feral animals are detrimental to pristine environments. Intact ecosystems are mostly restricted to inaccessible areas, but even in these places foreign plant seeds are brought by birds. Thousands of acres have been overrun by banana poka (*Passiflora mollissima*), clidemia (*Clidemia hirta*), and lantana, (*Lantana camara*). The native forests have been greatly reduced especially in cattle-damaged areas where the secondary growth consists of reforestation plantings or other exotics. An estimated 85% of the native forest that once covered most of O'ahu has been destroyed.

Introduced birds also carry foreign diseases to which native birds have no immunities. Accidentally introduced animals such as rats prey on land shells, tree snails, native birds and their eggs. Intentionally introduced animals not only destroy vegetation but also the dependent organisms.



Banana poka

Some, like the mongoose, prey on eggs of the ground-nesting native birds. African snails were brought to Hawai'i for "aesthetic" reasons in 1936. In 1955, *Euglandina rosea*, a cannibal snail, was released to combat the voracious African snails. The predator, however, also ate our native land and tree snails.

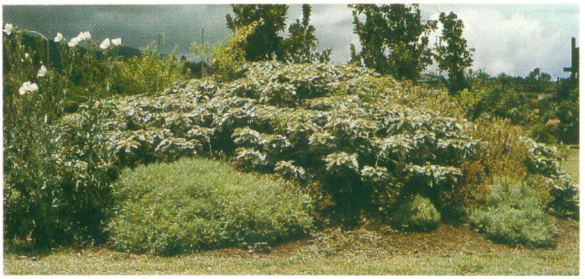
The Endangered Species Act of 1973 provided, for the first time ever, nationwide protection of native plants. In June, 1976 the U. S. Fish and Wildlife Service proposed to list some 1800 plants as endangered based on the Smithsonian Institution's report. Of these, 894 or nearly 50% were Hawaiian. In other words, one out of every three Hawaiian plants are being threatened with extinction.

Since then, only a few dozen have been officially listed. The first Hawaiian plant, designated in 1978, is a wild broadbean, *Vicia menziesii*, named for Dr. Archibald Menzies, a Scottish surgeon and botanist on three expeditions to Hawai'i by Captain George Vancouver. Consisting of a few hundred individuals, it was rediscovered in 1974 on Ke-au-hou Ranch on the slopes of Mauna Loa. Four more Island plants were added in 1979. Three, *Stenogyne angustifolia* var. *angustifolia, Haplostachys haplostachya* var. *angustifolia* and *Lipochaeta venosa* grow in a *kipuka* on the Big Island. The fourth, *Kokia cookei* (Cooke's *koki'o*) has been extirpated from the wild in its native range on Moloka'i. A sole specimen survives at the Waimea Arboretum on O'ahu.

In line with congressional amendments to the Act in 1978, the U. S. Fish and Wildlife Service has withdrawn five proposals for listing new wildlife, including the 1800 vascular plants. Each plant or animal must be supplemented with additional information before it can be reproposed and finalized. The work required to fully document each species is enormous. At the present rate, a few thousand years will be needed to officially protect all of Hawaii's endangered plants and aminals.

Hawaii's endangered species law

Banana poka in native forest, Kōke'e, Kaua'i



Maui Zoo and Botanic Garden

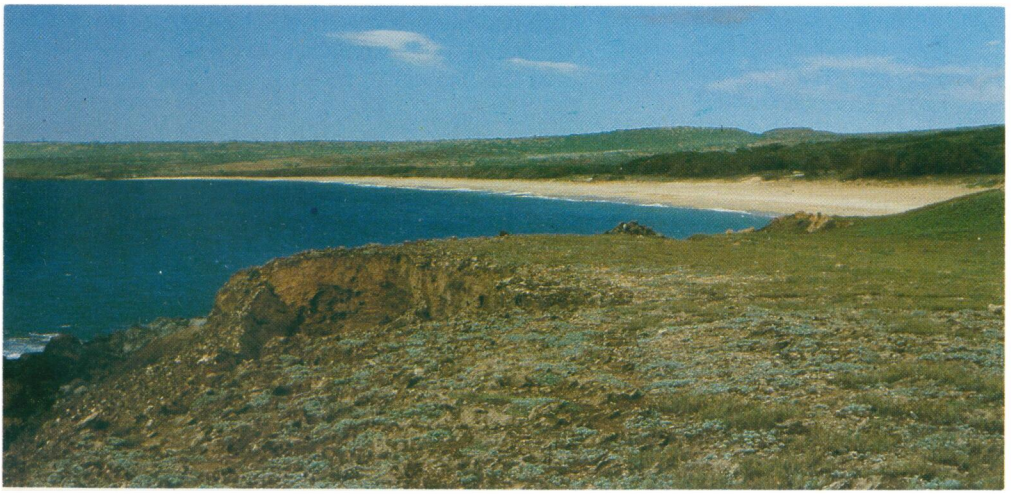
STATE OF HAWAII
AHIHI - KINAU
NATURAL AREA RESERVE
TAKING OR DISTURBING ANY NATURAL MATERIAL (ANIMAL, PLANT OR MINERAL) FROM RESERVE LAND AND WATERS IS PROHIBITED. Violators subject to fine and/or imprisonment.
Regulation 7 & Chapter 195, Hawaii Revised Statutes
Department of Land & Natural Resources
Natural Area Reserves System Commission

is an excellent one (Hawaii Revised Statues, HRS, Section 195D-4). Unlike the Federal Endangered Species Act, taking endangered plants is prohibited. In addition, the State can designate other plants and animals for protection. So far, it has not done so.

Native plants and animals must be protected in its native habitat. Building fences around individual trees or around a five acre plot, though impressive within, only serves to retard eventual extinction. Entire ecosystems should be carefully selected and set aside. Accessibility must be strictly controlled and hunting encouraged to minimize damage from introduced animals.

Hawaii's Natural Area Reserves System (HRS, Chapter 195) offers a positive way to conserve many plants and their environments. Although established in 1970, the full potential of this system has yet to be realized.

Progress, though seemingly painful at times, is apparent. More plants and animals, such as land snails of the genus *Achatinella,* will be added to the Federal Endangered Species list. Census surveys and recovery plans for endangered birds are underway. More Natural Area Reserves are being established. New directions will be set by the legislature and judiciary. Environmental awareness is growing. A concerted effort must be sustained. Everyone – conservationists and hunters, scientists and developers, natives and immigrants, hikers and ranchers, teachers and students – can *kōkua.* Native plants and animals are assets, not liabilities.



Mo'omomi, Moloka'i

Wai-ka-moi, East Maui

ACHYRANTHES SPLENDENS var. ROTUNDATA

Amaranthaceae

Having leaves that are blunt-tipped, nearly rounded and silver on both sides, this species is a shrub approaching 2 m in height. It is covered with short silky silvery hairs. Inconspicuous flowers are densely clustered on long terminal spikes up to 30 cm in length. Most of its known colonies are found on the 'Ewa Coral Plains scattered among the dense *Prosopis pallida (kiawe)* thickets. It grows in sunny areas with such native plants as *Myoporum sandwicense* var. *stellatum (naio)* and *Capparis sandwichiana* var. *zoharyi (maia-pilo)*. It has also been sighted at Ka'-ena, O'ahu. Another variety of *Achyranthes splendens* differs from *var. rotundata* by having narrower leaves that are usually greenish on the upper surface. This variety was once common in Kula on East Maui, behind Wai-luku and Lahaina on West Maui and on Lā-na'i. It is now probably extinct on East Maui and occurs only in scattered populations on West Maui.

There may be as many as several thousand of these plants at 'Ewa but many of them grow in areas designated for future deep-water harbor facilities. It seems to be reproducing satisfactorily but its habitat is being threatened by encroachment from the more aggresive *kiawe* and by human disturbances. One colony, easily accessible and well-known to scientists and students, was destroyed when a parking lot was constructed.

Hillebrand, W. 1965 reprint ed. *Flora of the Hawaiian Islands.* Hafner Publishing Co. New York and London. 673 pp.

LEPIDIUM SERRA

Brassicaceae

There are four kinds of native lepidiums in Hawai'i. Two are thought to be extinct and two are extremely rare. Of the 150 species in the genus, the Hawaiian ones are peculiar for they are among the woodiest of the group. While the common peppergrass of the northern hemisphere is usually a small annual herb, the Hawaiian lepidiums are large shrubs which may grow to over a meter in height. Other species in the genus which are arborescent can be found in the Canary Islands and Madeira.

Lepidium serra is a straggling shrub with long drooping branches and sharply toothed leaves that are crowded at the branch tips. It's small white flowers occur in large spreading terminal clusters. During the 19*th* century, it was recorded from the mountains between Hanapēpē and Wai-mea on Kaua'i. Although only a single colony is known today, it may still exist on the precipitous cliffs inaccessible to goats on the west and northwest coasts of the island. There are perhaps only five known plants in this colony and a fire sweeping through the gulch it inhabits may ultimately cause its demise.

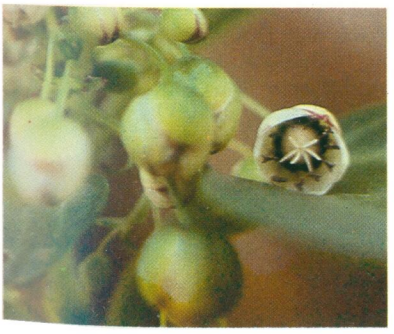
Hillebrand, W. 1965 reprint ed. *Flora of the Hawaiian Islands.* Hafner Publishing Co. New York and London. 673 pp.

ALSINODENDRON TRINERVE

Caryophyllaceae

Alsinodendron is an endemic genus of two species which are only found on O'ahu. *A. trinerve* was first collected in the Wai-'anae Mountains at about 600 m by the poet-naturalist Adelbert Chamisso who visited the islands in 1816 and 1823. It was also recorded in 1860 by Hillebrand from the summit and western slopes of Ka'ala between 600 m and 1200 m. Actually this species has been collected numerous times but mostly before 1950. Today it is rare and most of the modern collections are from a few well-known colonies. The bog on the summit of Ka'ala and the wet forest on its flanks were favorite sites for this plant. It also grows in the drier regions throughout the length of the Wai-'anae range.

Alsinodendron trinerve is an erect shrub about 0.4-0.8 m tall with brittle, yellow branches that are swollen at the nodes. Its somewhat fleshy leaves are prominently 3-veined. The fruits of this plant exhibit an unusual adaptation for seed dispersal. In the genus



Schiedea, the closest relative and probable ancestor of *Alsinodendron,* the sepals whither and fall from capsules. Upon maturity the capsules split allowing the wind to scatter its seeds. In *Alsinodendron,* the sepals become enlarged, purple in color and surround the capsule. When mature, its fruit resembles a berry that is probably dependent on birds for seed dispersal.

Because of its habit as a small shrub, *Alsinodendron* is likely to be unwittingly trampled by hikers or hunters and by feral animals. Perhaps the most serious threat to its existence is competition from introduced vegetation. This is especially true in the Ka'ala summit area. Once a favorite locality for observing this plant, the area has been invaded by grasses and blackberry to such an extent that *Alsinodendron* is almost extinct there.

Degener, O. 1932 et seq. *Flora Hawaiiensis.* Family 119

ARGYROXIPHIUM KAUENSE

Ka'ū silversword
Compositae

In 1911, C. N. Forbes located a silversword with dark-greyish leaves which were triangular rather than flat in cross section. Unfortunately the specimen was sterile. Eleven years later, W. H. Meinecke also observed it and again it lacked flowers or fruits. These specimens were named *Argyroxiphium sandwicense* DC. var. *macrocephalum* Gray by D. D. Keck. This plant could not definitely be identified as new to science until 1956. In July of that year, L. W. Bryan at last collected abundant flowering and fruiting material. A year later, J. F. Rock and M. C. Neal of the Bishop Museum named it a new variety of the well-known Hale-a-ka-lā silversword, calling it *A. sandwicense* var. *kauense*, in honor of the district in which the plant grows. The following year, Otto and Isa Degener, convinced that it was sufficiently different from *A. sandwicense,* renamed it as a new species.

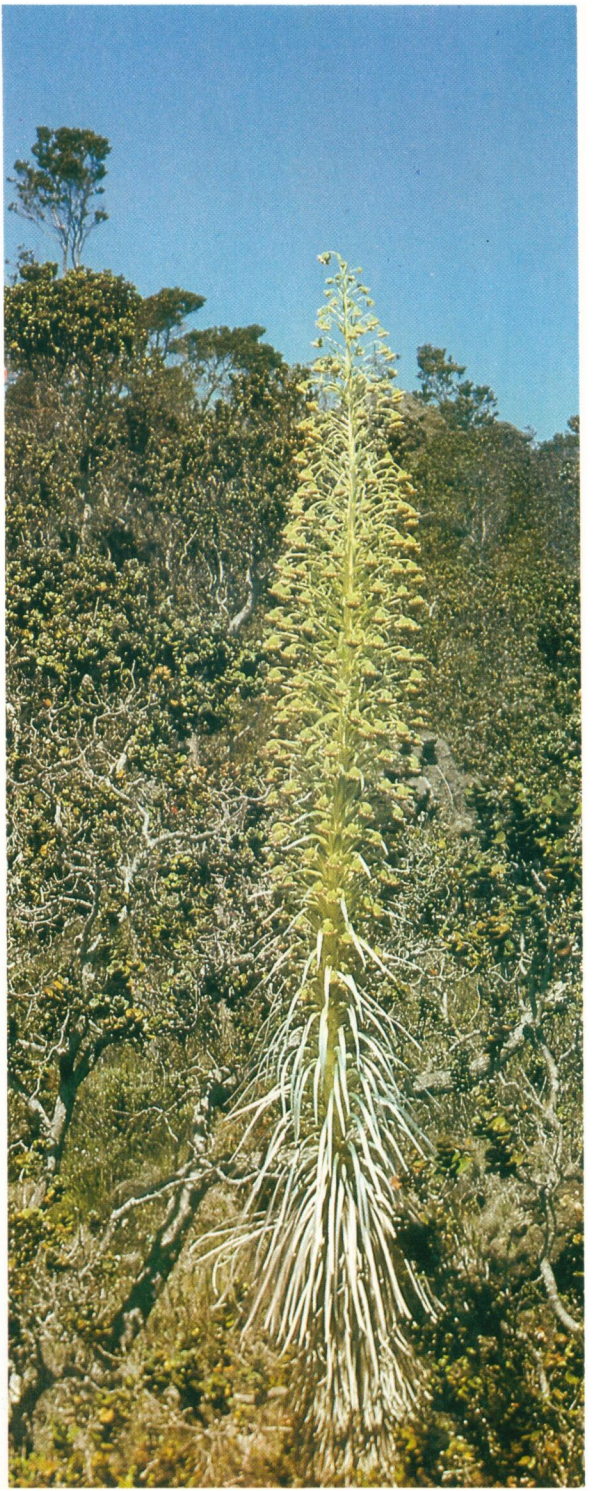
Other characters besides leaf shape which distinguish the Ka'ū silversword from its more famous relative include its smaller flowering spike and flower heads and fewer ray flowers (the "petals" of sunflowers and their relatives). There are usually less than 10

ray flowers in a flower head of the Ka'ū silversword but 20 or more in the Hale-a-ka-lā silversword. The leaves of the Ka'ū silversword grow to about 30 cm long and lacks the downy hairs which cover those of its Maui relative. The flowering stalk and flowerheads bear sticky hairs which prevent crawling insects from visiting the flowers.

Though its populations may number several thousand plants, most are near or on the active southwest rift of Mauna Loa. A lava flow could easily destroy these beautiful plants. Fortunately, they grow on rugged terrain at about 1800 m elevation and enjoy relative isolation from man and feral animals. Besides introduced insects, sheep may be the major predator of this species. Other plants near the Saddle Road, though relatively safe from lava flows, are being destroyed by goats.

Rock, J. F. & M. C. Neal. 1957. "A new variety of silversword." *B. P. Bishop Museum Occ. Papers.* 22(4):31-33

Degener, O. et al. 1976. "*Argyroxiphium kauense*, the Kau silversword." *Phytologia.* 33(3):173-177.



ARGYROXIPHIUM SANDWICENSE

'Āhinahina, silversword
Compositae

Hale-a-ka-lā, Maui

The silversword is world famous for its spectacular foliage and flowering spike. According to some, this very same species grows on Hawai'i and Maui. Others suggest that the Hawai'i species is different. The silversword was described from Hawai'i Island by DeCandolle in 1836. In 1852 the great American botanist Asa Gray established those with larger flower heads, conical receptacles, and no pappus as a new species, *Argyroxiphium macrocephalum.* Presumably, these included those on Hale-a-ka-lā, Maui. Later, D. D. Keck discovered that these characters were unreliable and considered it identical with *A. sandwicense.* Today, many believe that the Hale-a-ka-lā silversword should be called *A. macrocephalum* and that the Hawai'i ones, *A. sandwicense.*

At one time the silverswords on Hale-a-ka-lā were so abundant that they were uprooted and rolled down cindercones for sport. They were also harvested and shipped to the Orient for decoration. Such vandalism as well as predation by goats and insects caused an alarming decline in the population until in 1927, Degener counted

only 100 plants in the crater. Since then the National Park Service has instituted conservation programs and this beautiful species has been saved from almost certain extinction.

Much rarer and in grave danger of extinction is the Hawai'i population which grew on the barren wilderness above 2100 m on Mauna Loa, Mauna Kea and Hualālai. Just before his death, David Douglas (Douglas fir) used dead stalks and leaves of this species for his campfire. This may be indicative of its former abundance but it is uncertain how common it actually was. Today very few are known. Fortunately an enclosure has been constructed around the largest known population. Feral sheep threaten those outside the enclosure. Introduced insects damage the flowers and fruits of many plants.

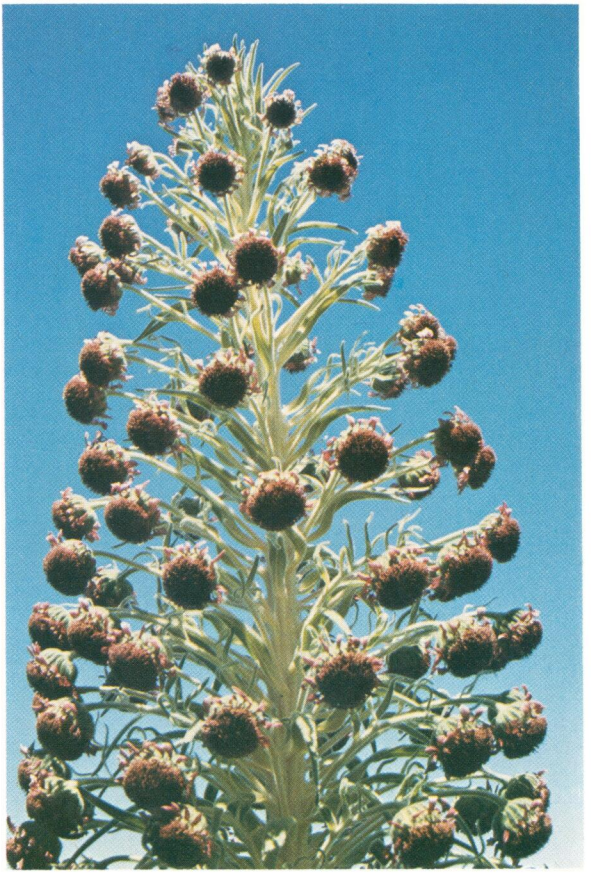
Argyroxiphium sandwicense is a rarely-branching plant with a basal rosette of leaves, each becoming about 40 cm long and densely clothed with silvery-white hair. The flower stalk grows to 2 m tall and may bear up to 500 nodding flower heads. The Ka'ū silversword bears a smaller flower stalk with fewer, about 150, flower heads. As in all species of silverswords, the plant dies after seeding.

Keck, D. D. 1936. "The Hawaiian silversword: systematic, affinities, and phytogeographic problems of the genus *Argyroxiphium*". B. P. Bishop Museum. *Occ. Papers.* 11(19):1-37

Degener, O. 1930. *Ferns and Flowering Plants of Hawaii National Park.* Honolulu Star Bulletin, Ltd. Honolulu, 313 pp.

Degener, O. 1932 et seq. *Flora Hawaiiensis.* Fam. 344.

Degener, O. 1948. "Silversword". *Hawaiian Digest.* March. pp. 23-27.



Mauna Kea, Hawai'i

BIDENS CUNEATA

Ko'oko'olau
Compositae

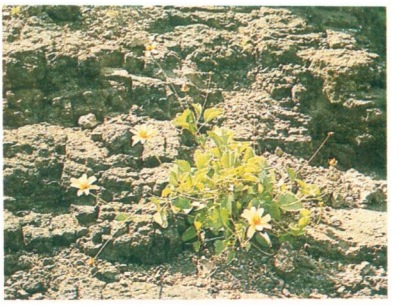
The Hawaiian species of *Bidens* apparently evolved from two separate ancestral stocks. The earlier introduction evolved into the large-flowered Kaua'i endemic, *B. cosmoides,* while a second developed into a multitude of species which inhabited ecological niches from sea level to over 2000 m elevation. About 70 species, varieties and forms have been described. Some trees become 3 m tall.

A subshrub rarely reaching 15 cm in height grows on the slopes of Diamond Head. It produces a solitary flower head at the end of a long peduncle 15 cm long. Its leaves are toothed at the margin. The plant was collected in 1903 by W. A. Bryan and named in 1920 by E. E. Sherff who guessed that it may have become extinct. Late one rainy April afternoon in 1955, this *ko'oko'olau* was relocated by two graduate botany students from the University of Hawaii, E. T. Ozaki and C. H. Lamoureux.

It grows in small pockets of soil in a single colony in an arid region. During years of little rainfall, most of the plants probably die, leaving their seeds to germinate with the first rains. The population fluctuates in synchronization with wet and dry years. During wet years as many as 30-40 plants may be seen. As the plants exist in an exposed area, it is doubtful whether they are able to survive in the shade. Thus, encroachment by such exotics as *Leucaena leucocephala (Koa-haole), Schinus terebinthifolius* (Christmasberry), and *Tridax procumbens* (tridax) pose an immediate threat to the survival of this species. In addition, rock slides may destroy the entire colony.

Based on hybridization experiments, G. W. Gillett theorized that this species may in actuality be a natural hybrid between *B. mauiensis* var. *cuneatoides* of Maui and *B. molokaiensis* of Moloka'i. These plants are somewhat alike in appearance and inhabit similar ecological niches, though on different islands. Alternatively, Gillett suggested that all three evolved separately from a common lineage.

Whether a distinct speices, a hybrid or a subspecies of the *B. mauiensis-B. molokaiensis* complex, this plant is extremely rare and in danger of extinction. We may never unravel its true lineage should it disappear forever.



Gillett, G. W. 1975. *The Diversity and History of Polynesian Bidens, Section Campylotheca.* Harold L. Lyon Arboretum Lecture No. 6. Honolulu. 32 pp.

Degener, O. 1932 et seq. *Flora Hawaiiensis.* Fam. 344.

BIDENS MAUIENSIS var. CUNEATOIDES

Ko'oko'olau
Compositae

There have been five varieties of *Bidens mauiensis* described based on leaf shape and amount of hair present. Typical *B. mauiensis* is described as having leaves divided into 3 to 5 leaflets. The var. *cuneatoides* differs by having leaves mostly simple and rarely 3-parted. The flowering head is solitary at the end of a long stem, much like *B. cuneata*, thus the reference in the varietal name. Rarely do the plants (excluding the flower stalks) exceed 15 cm in height.

Bidens mauiensis and *B. mauiensis* var. *cuneatoides* grow together in the fossil sand dunes near Wai-luku, Maui. These dunes have been nearly completely destroyed by cattle grazing, sugar production and by urbanization. Only two dunes have been spared and the ecosystem on the seaward side of these are still relatively pristine. True *B. mauiensis* can be found on them as well as on nearby dunes which are now dominated by *Prosopis pallida (kiawe)* because of cattle grazing, The var. *cuneatoides* is restricted to these two dunes which contain remnants of a nearly extinct coastal ecosystem.

Identifying the Hawaiian species of *Bidens* is very difficult. Gillett's work suggests that hybridization between various species may have been responsible for a great many natural hybrids which display a wide range of leaf and habit shapes. The problem becomes increasingly complex with the probability of nature variation and mutation.

Sherff, E.E. 1937. The genus *Bidens*. Field Museum of Natural History. *Bot. Series* Vol. 16. 709 pp.

BIDENS SKOTTSBERGII

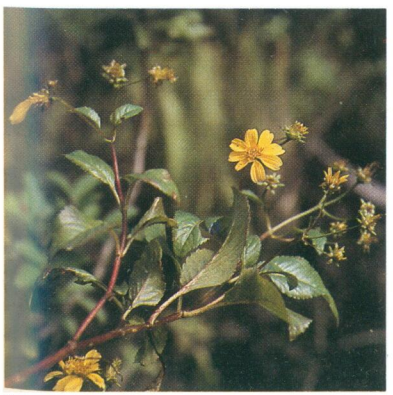
Ko'oko'olau
Compositae

Bidens skottsbergii

This species was first collected by the late, great Swedish botanist, Carl Skottsberg in 1926 near Puna, Hawai'i. Five years later, E. E. Sherff described it as new and named it after its collector. It is a shrub about one to two meters in height, with simple leaves and clusters of attractive flower heads. The heads often measure 3-4 cm or more in diameter. Ray florets, which measure about 1.5 to 2 cm long and 6-8 mm wide, are often deeply lobed. The achenes are long, straight and barbed. This plant is among the several Hawaiian species which have retained the barbs as a method of dispersal.

First believed restricted to the Ka-poho – Kai-mū area, this species has been discovered in Hawai'i Volcanoes National Park where at least two large colonies are known. Local residents often harvest the leaves for tea, much as the ancient Hawaiians did before Cook's arrival. Cattle are known to eat the plant but the greatest threat to its survival is the intermittent volcanic activity in the Kī-lau-ea region. Lava flows could easily eliminate them.

Plants with smaller ray florets measuring 1-1.4 cm long and 3-4.5 mm wide have been designated as variety *conglutinosa*. According to some, the flower size may be dependent on local climatic conditions and may not be significant enough to warrant separation into a new variety. *Bidens skottsbergii* var. *conglutinosa* grows in the same general localities as the species proper and is also harvested for tea.



B. skottsbergii var. *conglutinosa*

Sherff, E. E. 1937. The genus *Bidens*. Field Museum of Natural History. *Bot. Series* Vol. 16 709 pp.

BIDENS VALIDA

Ko'oko'olau
Compositae

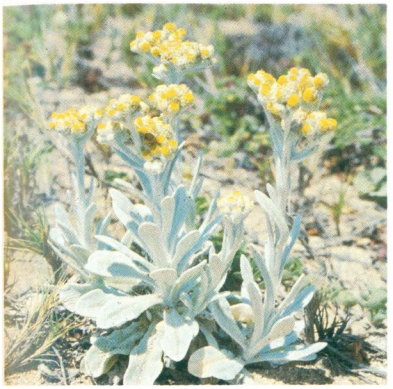
On the wet, windswept summits of the mountains in southeast Kaua'i grows a bidens with exceptionally large flowerheads. Named *Bidens valida* by E. E. Sherff in 1920, this sturdy species grows among ferns, lobelias and stunted vegetation on steep, windswept slopes where it is shaped by the wind into a dwarf shrub 0.5 m or sometimes attaining a height of 1.3 meters. Its somewhat leathery leaves are either simple, three-parted or rarely five parted and may exceed 30 cm in length. Usually occurring singly or in two's or three's on long peduncles, the flowerheads sometimes become 7 cm in diameter. Its conspicuous thick green bracts, large ray florets, and robust stature of the plants are distinctive. Appropriately named, *valida* means "robust-growing".

For nearly 60 years the only known specimen was the original collection made by Charles N. Forbes in 1909. In recent years, several plants have been identified as botanists began exploring the mountains of Kaua'i more intensively.

Sherff, E. E. 1937. The genus *Bidens*. Field Museum of Natural History. *Bot. Series* Vol. 16. 709 pp.

GNAPHALIUM SANDWICENSIUM var. MOLOKAIENSE

'Ena'ena, Hawaiian cudweed
Compositae



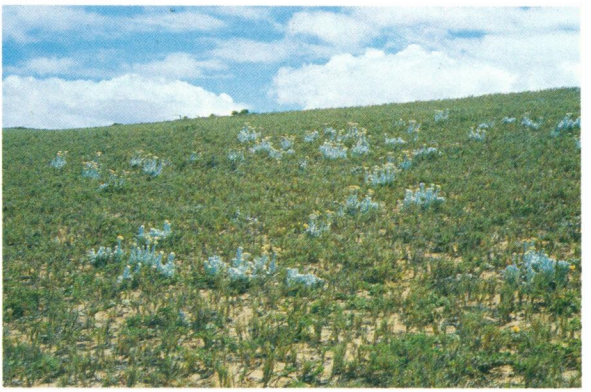
Of the five species of *Gnaphalium* in Hawai'i only two are native. One, *G. sandwicensium* is represented by four varieties which can be found on the islands of O'ahu, Moloka'i, Lā-na'i, Maui, Hawai'i, Midway and Kure where they inhabit the arid regions from sea level to 2700 meters. These are small, more or less hairy plants that grow 20-40 cm in height and bear flower heads in tight terminal clusters. The variety *molokaiense* differs from the others by being covered with a mat of dense, silvery, web-like hairs. Its leaves are 3-8 cm long and usually 3-8 mm wide.

Gnaphalium sandwicensium var. *molokaiense* is found only in West Moloka'i where it grows on the hot, coastal sand dunes. It was collected by Otto Degener in April, 1928 on the south shore of West Moloka'i and described as a new variety 20 years later. It is commonly found scattered on the sand dunes behind the beach where it grows with *Sida fallax ('ilima) Heliotropium anomalum* var. *argenteum (hinahina)* and *Lipochaeta integrifolia (nehe).*

The other native cudweed, *G. hawaiiense* Deg. & Sherff can be easily distinguished by its loosely clustered flower heads. This species emits a strong balsam-like fragrance and in the old days, it was placed in calabashes containing feathered cloaks as an insect repellant.

'Ena'ena, the Hawaiian name for our native gnaphaliums means "hot" and probably refers to the arid regions in which they are found.

Degener, O. 1932 et seq. *Flora Hawaiiensis.* Fam. 344



HESPEROMANNIA ARBUSCULA subsp. OAHUENSIS

Compositae

A rare endemic of the dry forests of the Wai-'anae Mountains, O'ahu, this unusual tree bears attractive bright orange, thistle-like flower heads about 6 cm long. Its flower heads emit a faint odor and occur on short-stemmed clusters of three's at the branch tips. Upon releasing the ripe seeds, the remnants of the flower clusters persist on the branches for up to a year. The broad leaves are greyish green in color, especially on the undersides which are covered with a mat of soft short hair.

Hesperomannia arbuscula subsp. *oahuensis* is a slender tree attaining a height of about 8 m with slender, drooping branches. Often the taller trees lean on and are supported by neighboring vegetation.

Early collections of this taxon were made in the second half of the 19*th* century by Dr. Heinrich Wawra and by John M. Lydgate who as a young man often accompanied William Hillebrand on his collecting trips. Several collections have been made during this century, some rather recent but many are from the same specimens. One small colony in the central portion of the Wai-'anae Range has been collected so often that many of the branches of the trees are broken at the tips. Small numbers and over-collecting are serious threats to its survival. Furthermore, its seeds are frequently infested with insects.

Hesperomannia is an endemic genus whose ancestor is believed to be a relatively early immigrant of South American origin.

Degener, O. 1932 et seq. *Flora Hawaiiensis.* Fam. 344 pp.

LIPOCHAETA FORBESII

Nehe
Compositae

Lipochaeta is an endemic genus of extremely variable plants which are usually adapted to sunny arid regions. They are sprawling or erect shrubs less than a meter high. There is much variation in the leaf shape which in the past was considered an important characteristic for distinguishing species. In all, some 65 taxa in 33 species have been described. In the latest monograph, however, only 27 taxa in 23 species are recognized.

On the south slopes of Hale-a-ka-lā, Maui, in the arid lava fields grows this erect, brittle-stemmed shrub with thin, 5-lobed leaves. Its branches and leaves are densely clothed with small hairs which gives the plant a somewhat grayish cast and a sandpapery texture. Its petioles possess a leafy margin that is toothed. The petiole base does not surround the stem. These features and the leaf shape were considered by Sherff to be salient characters of this species. Robert C. Gardner, in a more recent treatment of the genus, did not consider these important enough to be distinctly different from *Lipochaeta rockii.*

Whatever name is chosen, *Lipochaeta forbesii* or *L. rockii,*

it is a floral gem in the arid lava fields of south Hale-a-ka-lā. Its flower heads which are about 2.5 cm in diameter, occur in large clusters and bloom in great profusion during the early summer.

First collected by Charles N. Forbes in 1920, it was named in his honor in 1935.

Gardner, R. C. 1979. Revision of *Lipochaeta* (Compositae: Heliantheae) of the Hawaiian Islands. *Rhodora.* 81(827): 291-343.

Sherff, E. E. 1935. Revision of *Tetramolopium, Lipochaeta, Dubautia* and *Railliardia. B. P. Bishop Museum Bull.* 135. Honolulu. 136 pp.

LIPOCHAETA ROCKII

Nehe
Compositae

Of all *Lipochaeta* in Hawai'i, this species is probably the most variable. Plants in many populations possess leaves that are entire as well as deeply lobed. This extreme variability has resulted in mild controversy among botanists. In 1935, Sherff listed two varieties based on leaf size and outline but according to Gardner's 1970 account, none are recognized. Thus, the species includes plants with entire to deeply dissected leaves, having much variation in the petioles. *L. rockii* may possess petioles (leaf stem) with or without a leafy margin, and petioles that surround the stem; or it may be absent. In all, eight species and varieties have been included as synonyms in this latest description of *L. rockii.*

According to Sherff's concept of *L. rockii,* the species and one of its varieties are restricted to the arid foothills of Moloka'i. Another variety as found on West Maui. Although collected on O'ahu also, it hasn't been seen since the later half of the 1800's. According to Gardner's interpretation it is also found on south-central Maui and at least formerly on Kaho'olawe and on Hawai'i. The Hawai'i record is based on a single collection by David Nelson, a gardener who served as botanist during Cook's third voyage in 1779. It was named by Dr. Harold St. John as *L. scabra* and is most likely extinct today.

Usually found in arid regions along with scattered grasses, scrub *Leucaena leucocephala (koa-haole)* and *Sida ('ilima),* these shrubs add color during the summer and fall. These brittle-stemmed shrubs are covered with numerous stiff, minute hairs and are rough like sandpaper to the touch. Although broadly distributed, they are not abundant and on Moloka'i are browsed upon by goats and deer.

Gardner, R. C. 1979. "Revision of *Lipochaeta* (Compositae: Heliantheae) of the Hawaiian Islands." *Rhodora.* 81:291-343.

LIPOCHAETA SUCCULENTA

Nehe
Compositae

Another species with variable leaves is *Lipochaeta succulenta.* Sherff, the first monographer of the genus, recognized four varieties based on leaf shape and size. One variety, var. *trifida,* with three-lobed leaves, is called *L. rockii* by Gardner. He recognized that the characteristics of the remaining varieties intergrade to a large degree and leaf characteristics are influenced by water availability and light intensity. Consequently, he considered the varieties as merely extreme expressions of the species proper.

Lipochaeta succulenta is a sprawling shrub similar in habit to that common ornamental, wedelia, somewhat succulent but becoming woody at the base. Its flower heads are about 1.5 cm in diameter and are arranged singly or in small clusters. According to Sherff, *L. succulenta* has oblong leaves that are wider towards the tip and is found only on Kaua'i and Ni'ihau. In Gardner's view, the species has leaves that are narrow and lance-shaped to oblong with blunt or sharp tips and is found in small numbers on all the islands except Lā-na'i. It is generally found near the beach but occasionally futher inland at elevations of about 200 m. A thick layer of corky material surrounding the fruit aids in ocean dispersal.

Dr. George T. Lay and Alexander Collie are credited with the first record of *L. succulenta.* They were botanists aboard the "Blossom" under the command of Capt. Frederick W. Beechy during the voyage of 1826-1827 which made two visits to the islands. Collie made the collection on Ni'ihau and was the first botanist to visit there.

Gardner, R. C. 1979. "Revision of *Lipochaeta* (Compositae: Heliantheae) of the Hawaiian Islands." Rhodora. 81: 291-343.

Sherff, E. E. 1935. Revision of *Tetramolopium, Lipochaeta, Dubautia* and *Railliardia. B. P. Bishop Museum Bull.* 135. Honolulu. 136 pp.

LIPOCHAETA VENOSA

Nehe
Compositae

In June, 1910, while climbing a cinder cone in the South Kohala District on Hawai'i, Joseph F. Rock recorded a sprawling slender-branched shrub with rough, sandpapery leaves. E. E. Sherff named it twenty-three years later. *Lipochaeta venosa* has leaves that are usually triangular in shape and either simple or with three lobes, about 2-3 cm long on slender petioles. Its flower heads, about 1.5 cm in diameter are rather small and usually occur singly. The species resembles *L. subcordata* from which it can be distinguished by its smaller leaves (often lobed), fewer flowering heads and more disc florets.

Edward Y. Hosaka (in 1938) and Otto Degener (in 1949) made other collections on a different cinder cone in the same district. In 1977, it was re-discovered in old lava flows between Mauna Kea and Mauna Loa. There it grows in sunny areas among grasses and scrub vegetation. It appears restricted to an area of several square miles. Although many plants have been found, they are eaten by sheep and goats and are threatened by encroaching vegetation. The constant threat of fires and disturbance by military training exercises are more serious problems. Cattle have almost certainly extripated the population in South Kohala where a recent attempt to relocate it was unsuccessful.

In 1979 it was officially declared an endangered species by the U.S. Fish and Wildlife Service. A single large fire could destroy all the remaining plants of *L. venosa.*

Gardner, R. C. 1979. "Revision of *Lipochaeta* (Compositae: Heliantheae) of the Hawaiian Islands." Rhodora. 81: 291-343.

Herbst, D. & J. J. Fay. 1979. "Endangered and threatened wildlife and plants; determination that various plants are endangered." *Federal Register.* 44(211): 62468-42471.

Sherff, E. E. 1935. Revision of *Tetramolopium, Lipochaeta, Dubautia* and *Railliardia. B. P. Bishop Museum Bull.* 135. Honolulu. 136 pp.

REMYA MAUIENSIS

Maui Remya
Compositae

William (Wilhelm) Hillebrand is well-known to all students of the Hawaiian flora. A medical doctor by training, he resided in the islands between 1851 and 1871 during which he became a favorite family physician, one of the original physicians at Queen's Hospital, a member of the Board of Health, commissioner of the Bureau of Immigration and part-owner of a drugstore. A self-taught botanist, he travelled extensively throughout the major islands, collecting whenever he could. After leaving the islands he began working on his monumental *Flora of the Hawaiian Islands*, a task that would take him 15 years to complete. He died in the summer of 1886 after proofing the first few pages of his manuscript.

Hillebrand named the genus *Remya* to honor his friend Jules Remy. *Remya mauiensis* was collected by Hillebrand in the gulches behind Lahaina and near Wai-luku Valley. Until 1938, only one more collection site was known. Apparently it has never been very common and today it is known only from two localities about a mile apart in the West Maui mountains. Foraging by feral and domestic animals, possible genetic weaknesses resulting from inbreeding in extremely small populations and competition with exotic vegetation are serious threats to these plants.

Remya mauiensis is a highly branching shrub about 1 m tall with densely hairy and toothed leaves usually clustered at the tips of the branches. Tiny flower heads appear at the tips of the branches in long, hairy-stemmed clusters.

Hillebrand, W. 1965 reprint ed. *Flora of the Hawaiian Islands*. Hafner Publishing Co. New York and London. 673 pp.

TETRAMOLOPIUM CONSANGUINEUM var. LEPTOPHYLLUM

Compositae

The United States Exploring Expedition under the command of Charles Wilkes was the first major American scientific endeavor. It consisted of five ships and a group of scientists including Joseph D. Brackenridge, a horticulturist who proved to be an excellent botanist and Charles Pickering, a naturalist. The scientists spent about six months between 1840 and 1841 exploring Kaua'i, O'ahu, Maui and Hawai'i. *Tetramolopium consanguineum* was among the numerous plants documented. It was originally named *Vittadinia consanguineum* by Asa Gray who took over the study of plants collected following the death of John Torrey. Torrey was originally assigned this task. In 1934 E. E. Sherff discovered that the collections represented two varieties and consequently named one var. *leptophyllum*.

Originally collected at Wai-mea, Hawai'i, this variety is presently found only in the arid lava fields between Mauna Loa and Mauna Kea. Feral animals, the threat of fire and disturbances from military training exercises are serious problems. These slender shrubs may grow to about 1-2 m tall. They possess narrow leaves only about 1-1.5 mm wide sometimes to 3 mm and small flower heads less than 1 cm across. Originally thought to be extinct, it was rediscovered in January 1977 by a botanical survey team consisting of University of Hawai'i scientists.

Sherff, E. E. 1935. Revision of *Tetramolopium, Lipochaeta, Dubautia* and *Railliardia*. *B. P. Bishop Museum Bull.* 135. Honolulu. 136 pp.

DRYPETES PHYLLANTHOIDES

Mēhamehame
Euphorbiaceae

In February, 1912, Joseph Rock discovered three trees in South Kona, Hawai'i which he thought were of a new genus. He named this genus *Neowawraea* in honor of his friend Dr. Heinrich Wawra, Ritter von Fernsee, of the Austrian Exploring Expedition. Later these trees were found to be of the genus *Drypetes*. Rock knew of only those three trees on Hawai'i. Today it is also known from the dry forests of O'ahu, Kaua'i and Maui.

A giant of a tree, it may grow to 20 m or more in height and nearly 2 m in diameter. Its bark is rough, scaly and its dark heart wood is hard enough to dull the sharpest machetes.

Only a few individuals are alive today on O'ahu, where perhaps a dozen are scattered in the Wai-'anae Mountains, they are infested with the black twig borer that causes stem die back. One gulch in the northern portion must have supported one of the largest populations of this species. Judging from the number of dead stumps and the seven live specimens, the original colony is estimated to have been at least twenty.

Only one sapling and one seedling have been found. These trees are unisexual and because of the extremely small numbers of individuals, seeds are seldom seen. Years ago, the Division of Forestry harvested a crop of seeds and successfully germinated them but none of the seedlings survived.

The introduced twig borer, small populations and its inability to reproduce successfully may ultimately lead it its demise. Most of the extant specimens are half dead or dying.

Rock, J. F. 1913. *The Indigenous Trees of the Hawaiian Islands.* Published under patronage. 518 pp.

EUPHORBIA CELASTROIDES var. KAENANA

Euphorbiaceae

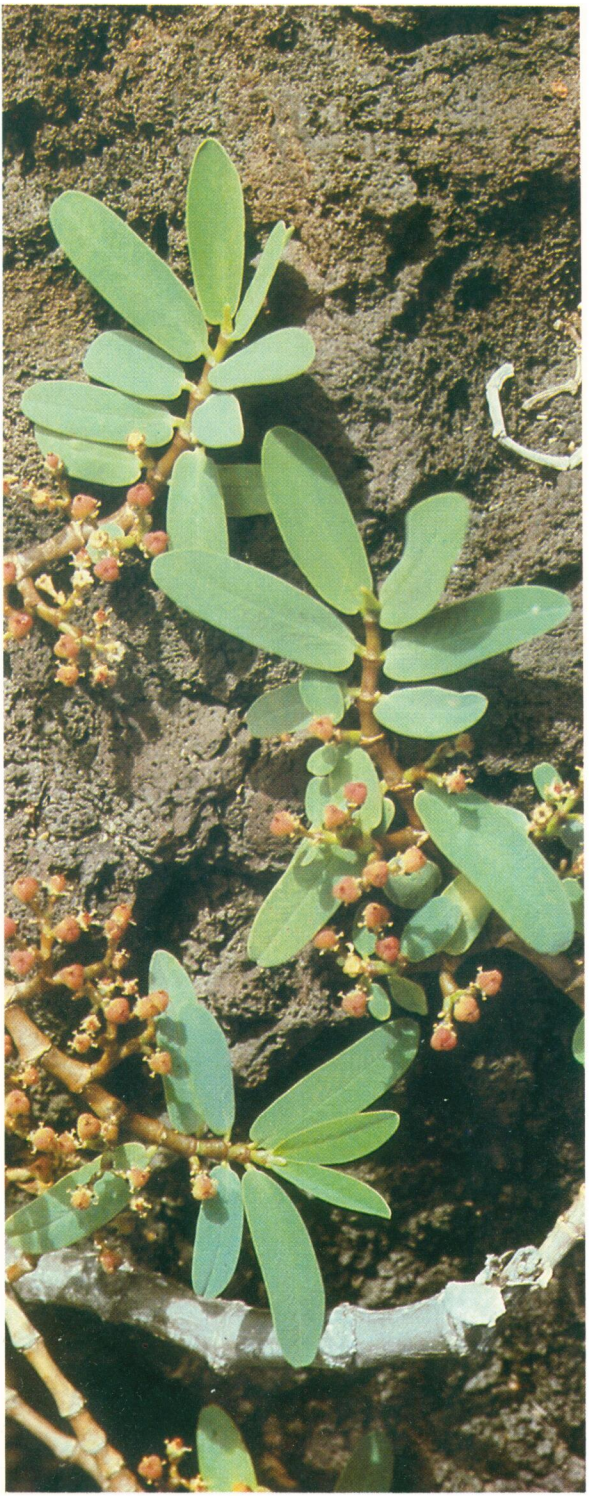
The genus *Euphorbia* was named for Euphorbus, a physician to King Juba of Mauretania an ancient kingdom in North Africa. A large genus of over 1500 species, its Hawaiian members have probably evolved from two ancient species into a complex array of about 60 species and varieties. They inhabit arid shorelines, the lowland foothills and the mountains. Shoreline species are low growing, mat forming shurbs while those in the foothills and drier mid-elevations tend to be upright shrubs. There are three species that become trees 10-14 m tall. These are

found on the wet summit areas of the Ko'olau Mountains, the moist ravines in the northern Wai-'anae Mountains on O'ahu and in moist valleys on northwest Kaua'i.

Euphorbia celastroides is a spreading shrub usually found in dry areas at low or mid elevations or along coastal cliffs. There are about 20 varieties and forms of the species, most of them restricted to a single island or a single locality. *E. celastroides* var. *kaenana* is found only at Ka-'ena, O'ahu where it grows in the dry scrub among the rocks of the talus slopes behind the beach area. It is a spreading upright shrub one meter or less in height with thick branches and somewhat bluish green leaves. During the dry season, the leaves fall off to conserve water and the plant relies on the water stored in its thick stems.

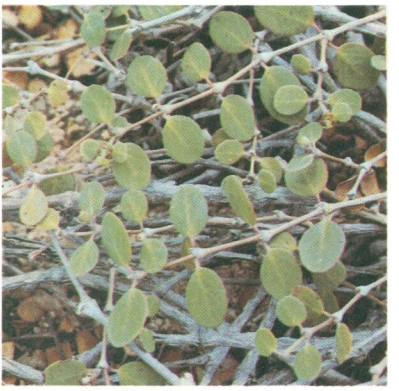
It was first documented in 1911 by Charles N. Forbes along the coast below Mākua Valley and Ka-'ena Point. The variety is named for the locality where it grows.

Sherff, E. E. 1938. "Revision of the Hawaiian species of *Euphorbia*". *Annals Missouri Bot. Gard.* 25 (1): 28-29.



EUPHORBIA SKOTTSBERGII

Euphorbiaceae



E. skottsbergii var. audens, Mo'omomi, Moloka'i

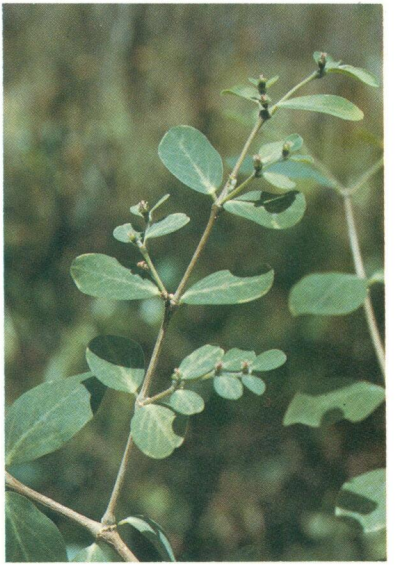
Euphorbia skottsbergii was described as a new species in 1936 by E. E. Sherff from a specimen collected in 1922 on the 'Ewa Coral Plains, O'ahu. This was a low mat-forming plant with very slender branchlets with oblong to nearly round leaves about 2 cm long and 1 cm wide. The native plants and animals that existed on the coral flats have been reduced by grazing, encroachment by introduced plants like *Prosopis pallida (kiawe)* and by the expanding sugarcane operations. Certainly by the turn of the 20*th* century the destruction of this native ecosystem must have been well underway. Perhaps this species was very rare to begin with as it was recorded less than six times. It has been not seen since 1932.

A variety of this species, var. *kalaeloana,* still exists among the *kiawe* thickets. Differing from its probably-extinct relative by being an erect plant approaching one meter in height and having smaller leaves, it seems to be sustaining itself in this modified environment.

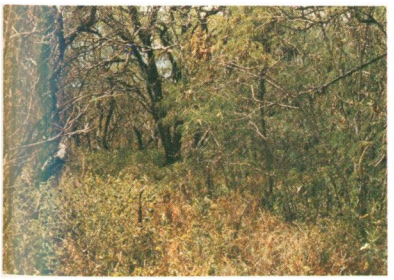
Several thousand plants are known to exist but most grow in an area designated for future deep-water harbor facilities.

Two other varieties of *E. skottsbergii* grew in arid areas on Moloka'i. One, var. *vaccinioides* is probably extinct while the other, var: *audens,* exists in small numbers along the west and northwest coasts. This plant also forms mats but differs from the species proper by having 3-10 teeth along its leaf margins. Its capsules are less than 2 mm tall. West Moloka'i supports a large population of deer which often browse along coastal areas but it is not known whether they favor these milky-sapped plants. The decumbent habit, small leaves and thick, deep top root enable this variety to survive in hot, arid sites.

Sherff, E. E. 1938. "Revision of the Hawaiian species of *Euphorbia.*" *Annals Missouri Bot. Gard.* 25 (1): 54-56.



E. skottsbergii var. kalaeloana



Kiawe thicket. 'Ewa Plains, O'ahu

SCAEVOLA CORIACEA

Naupaka
Goodeniaceae

This extremely rare *naupaka* is well-adapted to the harsh coastal environment. It is a low spreading shrub with trailing stems no thicker than a pencil and round, succulent leaves. Like most other Hawaiian *naupaka,* their flowers are split down one side giving the appearance of a half-flower. The petals are about 15-18 mm long and are covered with cobwebby hairs on the inside. Unlike the common coastal *Scaevola,* the fruits of this species are small and black.

At one time *Scaevola coriacea* was probably found on all the major Hawaiian Islands. David Nelson, Capt. Cook's botanist on the third voyage, first noted this species. Presumably this occured on Hawai'i as his only journey ashore was on that island. The United States Exploring Expedition again collected it on Hawai'i as well as on Maui during its six-month stay in the islands between 1840 and 1841. Hillebrand reported it from Kaua'i and the French botanist Jules Remy collected it on Moloka'i and Ni'ihau. On Lā-na'i it was documented by Harold St. John in 1938. It has

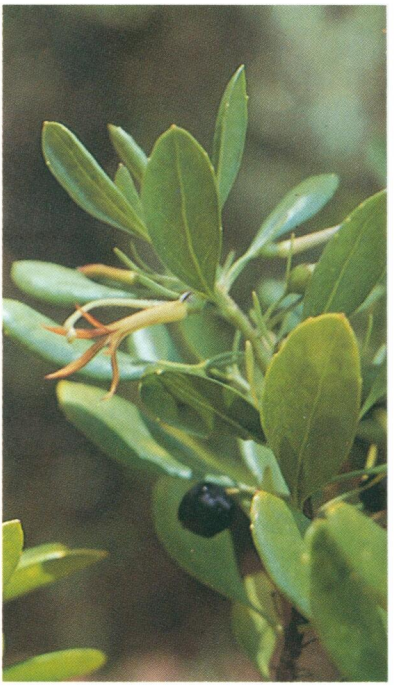
not been seen on O'ahu since Joseph Rock collected it at Barber's Point in 1919.

Only two populations on Maui exist today. For many years only one, situated on the sand dunes of Wai-ehu, was known. This habitat is the only surviving portion of a unique and extensive sand dune ecosystem which once covered the Ka-hului area. Recently, a second population was discovered along the southern shore of East Maui.

Degener, O. 1932 et seq. *Flora Hawaiiensis.* Fam. 340.

SCAEVOLA GAUDICHAUDII

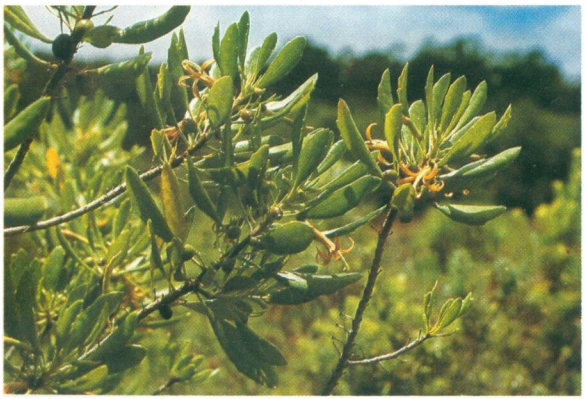
Naupaka
Goodeniaceae



The first name given to this *naupaka* was Gaudichaud's *Scaevola montana,* a name previously applied to a New Caledonia species. Later, Hooker and Arnott named Lay and Collie's collection of this plant *Scaevola gaudichaudii.* Dr. George T. Lay and Alexander Collie were the botanists aboard the "Blossom" which visited the islands twice in 1826-1827.

Scaevola gaudichaudii is a small woody shrub 0.5-2 m tall branching at the base. Smooth, leathery leaves are about 4 cm long. This is one of very few Hawaiian dry forest *Scaevola* with distinctly yellow flowers. These flowers, about 2-2.5 cm long, are borne singly on short pedicels about 5 mm long. Fruits are dark purple.

Found in dryland habitats, *S. gaudichaudii* has been collected on all the larger Hawaiian Islands. On O'ahu it once inhabited the foothills behind Honolulu from Wa'ahila Ridge to Niu Valley. These habitats have since been replaced by subdivisions. It is still found in the northern portion of the Wai-'anae Mts. on O'ahu, the dry regions near Kōke'e on Kaua'i and in the West Maui mountains.



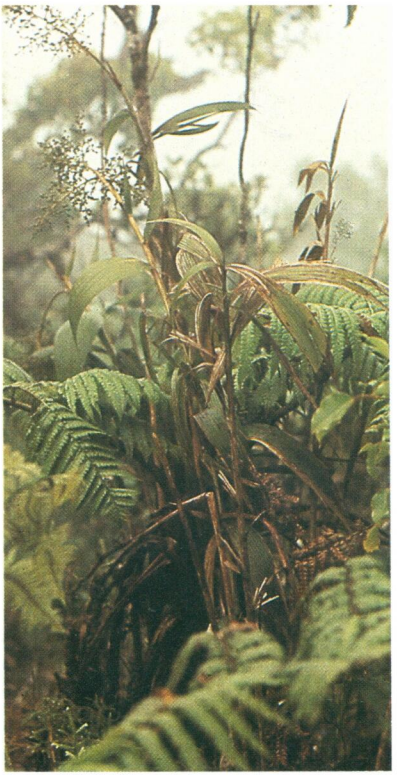
Gillett, G. W. 1969. "The nomenclatural and taxonomic status of the Hawaiian shrub *Scaevola gaudichaudii* H. & A." *Pac. Sci.* 23: 125-128

JOINVILLEA ASCENDENS subsp. ASCENDENS

'Ohe
Joinvilleaceae

During his second world voyage in 1836-1837 Charles Gaudichaud Beaupre botanized for six weeks on O'ahu and Hawai'i, before continuing on to the Philippines, Indonesia and India. At the Museum d'Histoire Naturelle in Paris he worked on the plants collected during the voyage and published an *Atlas* containing 150 folio plates but no descriptions, no citation of specimens and no localities. Under the present rules of nomenclature if an illustration published before 1908 adequately shows the essential characters of the plant, including flowers and fruits, that plant is adequately described and its name is valid. Two different *Joinvillea* were illustrated in the *Atlas,* one adequately descriptive and the other inadequately illustrated. The validly named one is definitely non-Hawaiian but the other has been the source of much confusion. It has undergone several name changes and today it is generally accepted as *J. ascendens* subsp. *ascendens.*

This rare plant usually inhabits the wet forests of all the larger islands of Hawai'i. It was known to most of the early botanists, as Hillebrand, Remy, Forbes, Macrae and Mann all collected it. Resembling a giant widebladed grass, this plant grows to 4 m tall. Its plaited leaf blades are 0.5 to nearly a meter in length and 8-10 cm wide and its hollow, unbranched stems may become 2 cm in diameter at the base. Its small flowers occur on terminal clusters.



St. John, H. 1978. "Revision of *Joinvillea* (Joinvilleaceae). Pacific Plant Studies. 37." *Phytologia.* 40: 369-374.

HAPLOSTACHYS HAPLOSTACHYA var. ANGUSTIFOLIA

Labiatae

Haplostachys is an endemic genus of five species and five varieties which was thought to be extinct until 1977. Then in January of that year *Haplostachys haplostachya* var. *angustifolia* was re-discovered in the arid *a'a* fields between Mauna Loa and Mauna Kea on Hawai'i. This shrub grows to about 0.8 meters tall and is densely covered with soft downy hair which is especially conspicuous on young stems and undersides of the leaves. As is typical of many native mints, the stems are square in cross section. Its leaves are arrow-head-shaped and about 5-10 cm long. During hot dry summers these plants appear dormant only to spring to life again with the winter rains. Thousands of seedlings sprout during these rains but most succumb to browsing animals and prolonged dry spells. Wet seasons also produce an abundance of fragrant white flowers 2.5 cm long on terminal spikes.

The species was first collected by the United States Exploring Expedition on Maui in 1840. Its variety was collected on Hawai'i by the French naturalist Jules Remy. The variety was named by E. E. Sherff in 1934. Until 1977 only five collections were known, the last one being in 1949. Although the exact locality of the Remy collection is not known, it was probably in the South Kohala District as most of the other collections were from the cinder cones in that region. In all probability cattle have destroyed the plants in those early collection sites. Plants found in the Pōhaku-loa area are all that remain of an entire genus.

Sheep and goats that infest both Mauna Kea and Mauna Loa pose an immediate threat for its survival. Brush fires are a constant menace to the entire population. Military maneuvers and encroaching vegetation pose additional threats. In winter, 1979, this plant was officially listed by the U.S. Fish and Wildlife Service as an endangered species.

Herbst, D. & J. J. Fay. 1979. "Endangered and threatened wildlife and plants; determination that various plants are endangered." *Federal Register.*

Sherff, E. E. 1935. Revision of *Haplostachys, Phyllostegia,* and *Stenogyne. B.P. Bishop Museum Bull.* 136. Honolulu. 101 pp.

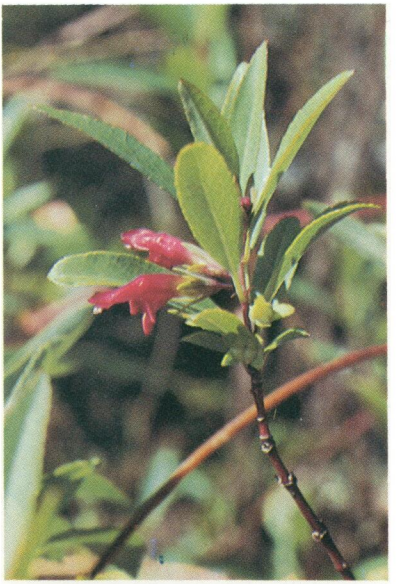
STENOGYNE ANGUSTIFOLIA var. ANGUSTIFOLIA

Labiatae

Another species re-discovered in the arid lava fields near Pōhakuloa, Hawai'i is this sprawling shrub with slender trailing stems. It was first found in an unspecified locality in the Wai-mea district by the United States Exploring Expedition in 1840 and subsequently by William Hillebrand and by Dr. Heinrich Wawra. It was collected twice early in this century but was thought to be extinct until 1977 when a botanical survey team consisting of University of Hawai'i botanists discovered it growing not far from the *Haplostachys.*

Stenogyne angustifolia var. *angustifolia* has red flowers about 2-2.5 cm long. They occur in pairs in the axils of the narrow leaves. There are five varieties of *S. angustifolia* based in part on leaf shape and size. Three are endemic to the Big Island, one to Maui and one to Moloka'i. Three are considered rare.

In 1979, this variety added to the federal endangered species list. It grows in the same habitat as two other officially endangered species, *Haplostachys haplostachya* var. *angustifolia* and *Lipochaeta venosa* and encounters the same threats – fire, browsing animals, crowding by exotic vegetation and disturbance by man. Fewer than 100 individuals exist.

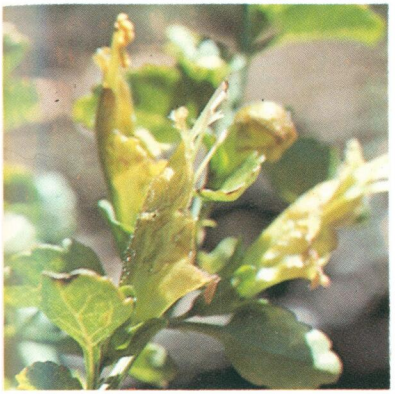


Herbst, D. & J. J. Fay. 1979. "Endangered and threatened wildlife and plants; determination that various plants are endangered." *Federal Register.* 44(211): 62458-42471.

Sherff, E.E. 1935. Revision of *Haplostachys, Phyllostegia,* and *Stenogyne. B.P. Bishop Museum Bull.* 136. Honolulu. 101 pp.

STENOGYNE DIFFUSA var. GLABRA

Labiatae



Two varieties of *Stenogyne diffusa* have been described. In 1840 the United States Exploring Expedition collected a specimen with small leaves that were covered on the undersides with short but dense hairs. Asa Gray who identified much of the plants collected during the expedition, named it *S. diffusa* in 1862. Ten years later, Dr. Heinrich Wawra described variety *glabra* based on a specimen collected by William Hillebrand. There were few or no hairs on the leaves. Apart from this small difference both varieties seem identical. Both are much-branched shrubs with leaves about 3-8 mm long and small flowers with petals about 1.4-1.8 mm long. The petals are greenish-yellow to rose colored.

Typical *Stenogyne diffusa* has not been seen since it was first documented in the forests near Wai-mea, Hawai'i. The variety *glabra* has been recorded several times throughout the first decade of this century but has seldom been seen since. It is widely distributed in the high elevations on the Big Island from Mauna Kea through the great central plateau southwest to Hualālai.

Feral animals feed on vegetation within their reach. Trees and shrubs in heavily grazed areas often exhibit a "browse line". Above this line, vegetative growth is lush. Below it, the plant is completely denuded of leaves and young stems. *Stenogyne diffusa* is usually a climbing shrub which entwines with other vegetation. Protected by the branches of its supporting plant, *Stenogyne* escapes the ravages of these animals.

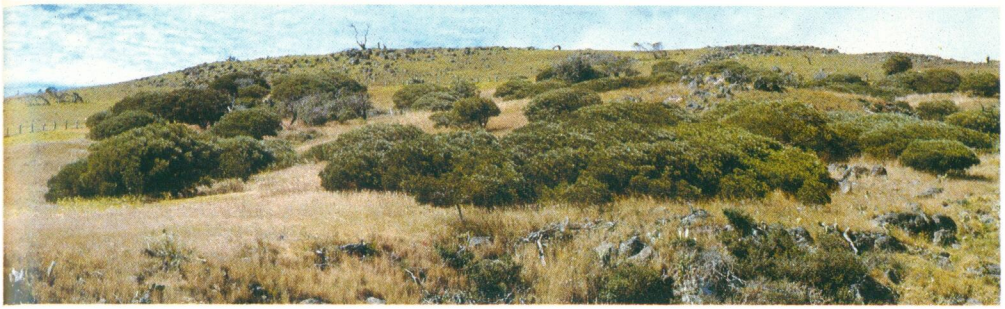
Sherff, E. E. 1935. Revision of *Haplostachys, Phyllostegia,* and *Stenogyne. B.P. Bishop Museum Bull.* 136. Honolulu. 101 pp.

ACACIA KOAIA

Koai'a, Koai'e
Leguminosae

The genus *Acacia* has modified petioles (leaf stems) called *phyllodes* that function as leaves. At a distance, these plants appear to have sickle-shaped leaves similar to many eucalyptus trees. The leaves are bipinnately compound with numerous small leaflets and are usually present only on seedlings, saplings or on broken limbs. This loss of true leaves is an adaptation for survival in dry areas since phyllodes possess a smaller surface area.

Acacia koaia is a small dense somewhat gnarled tree rarely exceeding 8 m in height. Its phyllodes are narrow, rarely ex-

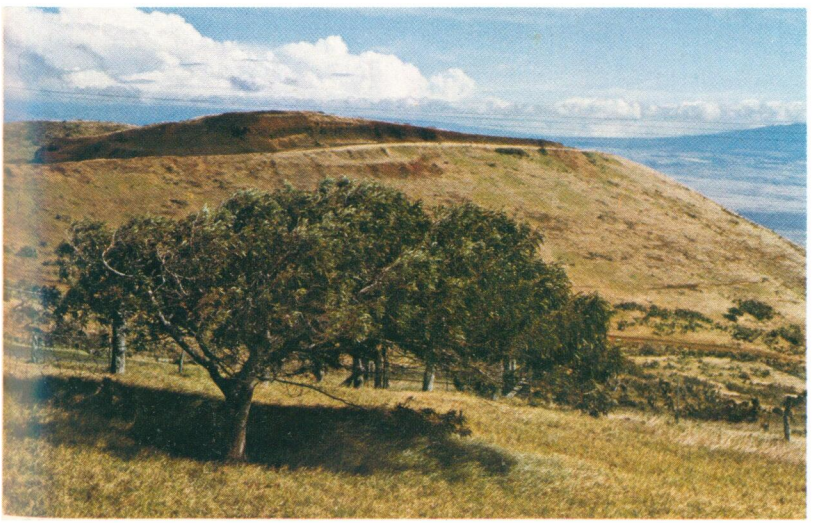


ceeding 12 cm long and 1 cm wide. Its seed pods are curved and approximately the same size as the phyllodes. A more common and famous relative, the Hawaiian *koa (A. koa)* is an immense tree with broader and often more strongly curved phyllodes and broader but straighter pods. *Koa* wood was used by ancient Hawaiians for making canoes and tools. *Koai'a* wood is much harder and closer-grained than *koa* and was used for making fancy paddles and spears.

Hillebrand discovered this species on Moloka'i and on East Maui and named it in his *Flora of the Hawaiian Islands.* Rock also found it on Moloka'i in 1910. In 1937, Degener failed to locate it on that island. Degener noted that the species was still relatively common along the road in West Kohala in 1930. It is adapted to the dry regions below 800 m and has been recorded from Lā-na'i. Today its habitat has been largely destroyed by cattle and goats. Only a few trees are known to exist on Lā-na'i and Hawai'i. It has not been seen on Maui since Hillebrand's time and may already be extirpated from Moloka'i. Except at the Division of Forestry's Koai'a Tree Sanctuary, it is nearly impossible to find in Kohala. There its habitat has been converted to pasture.

Degener, O. 1932 et seq. *Flora Hawaiiensis.* Fam 169a.

Rock, J.F. 1913. *The Indigenous Trees of the Hawaiian Islands.* Published under patronage. 512 pp.



CANAVALIA HALEAKALAENSIS

Leguminosae

The arid lava fields of the southern flanks of Hale-a-ka-lā, East Maui is the home of this ornamental vine. A dense mat of soft, velvety hair gives a silvery appearance in contrast to the scrub vegetation upon which it climbs. Its pea shaped flowers occur on short shoots, are dark red to purple in color and about 3 cm long. Its pods are straight, up to 16 cm by 3 cm and are covered with short white hair. Six to eight shining reddish brown seeds are found in each pod.

Superficially, the Hale-a-ka-lā canavalia resembles the introduced *Canavalia sericea (pōhue)* brought to Hawai'i by G. P. Wilder some time before 1920 from Raratonga. Today *C. sericea* is occasionally found naturalized in coastal areas on O'ahu and Maui.

Canavalia haelakalaensis was first recorded by Charles N. Forbes, former Curator of Botany at the Bishop Museum in March, 1920. Since then it has been collected less than six times. In 1970, Dr. Harold

St. John of the Bishop Museum described it as a new species.

Botanists have differed over the number of native *Canavalia* in Hawai'i. J. Sauer in his world monograph accepted five species but later F. R. Fosberg considered them as one species and four varieties. St. John lists 18 endemic species.

St. John, H. 1970. Revision of the Hawaiian species of *Canavalia* (Leguminosae). Hawaiian Plant Studs. 32. *Israel Journ. Bot.* 19: 161-219.

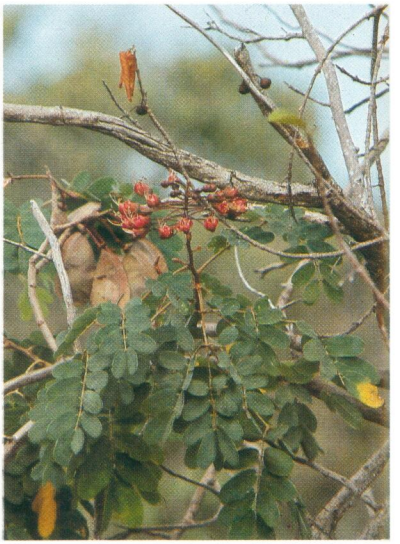
MEZONEURON KAVAIENSE

Uhiuhi, kea
Leguminosae

Horace Mann first described this tree from a Kaua'i specimen but this species is more common on the Kona side of the island of Hawai'i. It is almost extinct on Kaua'i, Maui and O'ahu. In 1913 Rock noted "quite a number" of trees in North Kona, Hawai'i. Today several can be seen along Māmahaloa Highway between Hu'ehu'e and Pu'u-wa'awa'a. Its abundance is deceiving since less than 50 trees are found there.

Known as *uhiuhi* or *kea,* it is famous for its extremely hard, resistant, ebony-colored wood which was made into spears, tapa-beaters, runners for *hōlua* (sleds), digging sticks, and house frames. The wood is extremely dense and will sink in water. The bark is scaly and light-colored. *Uhiuhi* will grow to about 10 m in height and its pinnately compound leaves resemble those of the common ornamental, *Cassia surratensis (kolomona).* Its pods are broad and flat and are pinkish when young. Upon maturity they become brown and about 9 cm long and 5 cm wide. Each pod bears two to four hard seeds. Seeds of other mezoneurons float in water and although the Hawaiian one does not, it is believed to have arrived in that manner and then lost its ability to float.

Uhiuhi seeds are viable as botanical gardens have been successful in propagating this nearly extinct species. Very few seedling have ever been seen. Rats are known to eat the seeds while the pods are still on the trees. Hooved animals are thought to be another major threat to its survival.



Hillebrand, W. 1965 reprint ed. *Flora of the Hawaiian Islands.* Hafner Publishing Co. New York and London. 673 pp.

Rock J. F. 1913. *The Indigenous Trees of the Hawaiian Islands.* Published under patronage. 518 pp.

SESBANIA MOLOKAIENSIS

'Ohai
Leguminosae

A rare species of *Sesbania* grows on the north coast of West Moloka'i. It is a dense, usually prostrate, spreading shrub with long, creeping branches that often root themselves. This species differs from the more common *S. tomentosa* by having narrow flowers about 3 cm long that are darker red in color.

The species was collected by Joseph Rock in about 1909 and again several years later by Charles N. Forbes. In April 1928, Otto Degener noted that it was on the verge of extinction. It was described as a new variety, *S. tomentosa* var. *molokaiensis*, in 1949. In 1978 it was renamed *Sesbania molokaiensis*.

This attractive coastal shrub is restricted in distribution to the north shore of West Moloka'i. It usually grow on sand dunes in exposed areas along with *Scaevola taccada* (beach *naupaka), Prosopis pallida (kiawe), Sporobolus virginicus ('aki'aki)* and *Heliotropium anomalum* var. *argenteum (hinahina).*

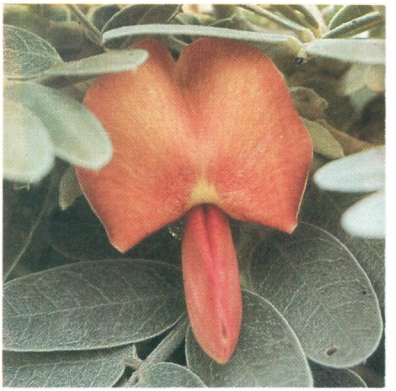
Today so few of these plants remain. Young shoots are eaten by cattle and probably by deer also. Seeds are eaten by birds. Its existence is endangered.

Degener, O. and I. Degener. 1978. "Kaena Point, Hawaiian Islands and a prodromus regarding some taxa in *Sesbania* (Leguminosae)". *Phytologia.* 39(3):147-160.

Sherff, E. E. 1949. "Miscellaneous notes on dicotyledonous plants." *Amer. Journ. Bot.* 36:499-511.

SESBANIA TOMENTOSA

'Ōhai
Leguminosae



Once found on O'ahu, Necker and Nihoa, *Sesbania tomentosa* has been sadly pre-empted from most of its natural habitats. Today it is still found on the Leeward Islands and on some of the small off-shore islets around O'ahu and at Ka-'ena, O'ahu. In 1946 Otto Degener estimated that only 40 plants grew on the limestone and clay from Moku-lē'ia west to Ka-'ena, the only remaining habitat on O'ahu of this beautiful coastal species. Twelve years prior, it was collected on Mō-kapu Crater on the windward side of O'ahu. It has not been seen there since.

Sesbania tomentosa was one of the plants collected by George T. Lay and Alexander Collie. The plants collected on this voyage were sent to Kew Gardens where they were studied by W. J. Hooker and G. A. Walker Arnott. When Hooker and Arnott described it in 1836 they erroneously recorded it from Acapulco, Mexico.

This plant is a low growing, spreading shrub with salmon-colored, pea-shaped flowers and silvery green leaves covered with minute hair to aid in reflecting the sun's rays. It may grow to a meter in height. On O'ahu, its habitat is in grave danger of destruction by off-road vehicles (ORV). In addition to physically destroying plants, ORV's also obliterate the fragile sand dune ecosystem and coral flats.

Its common name, *'ōhai,* is also given to *Samanea saman*, the monkeypod tree.

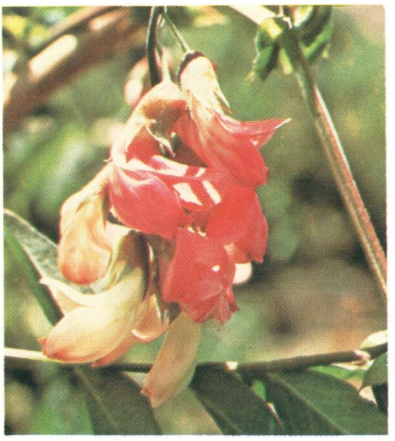
Hillebrand, W. 1965. reprint ed. *Flora of the Hawaiian Islands.* Hafner Publishing Co. New York and London. 673 pp.
Degener, O. 1932 et seq. *Flora Hawaiiensis* Fam. 169c.

VICIA MENZIESII

Hawaiian wild broadbean
Hawaiian vetch
Leguminosae

Vicia menziesii was the first Hawaiian plant to be officially listed by the federal government as an endangered species. It was first collected by Menzies in the upper edge of the forest zone on Mauna Loa, Hawai'i during one of Vancouver's visits to the islands between 1792 and 1794. It was named *Vicia grandiflora* by Smith in 1819. James Macrae, the Scottish botanist who came aboard the HMS "Blonde" recorded it in 1825. In the following year, C. P. J. Sprengel finding that the name *V. grandiflora* had already been used for another plant, renamed the Hawaiian species in honor of its discoverer. Jules Remy collected it between 1851 and 1855 and it was not seen again until June, 1915. During this century, botanists such as J. F. Rock and O. Degener have searched in vain for this species and for nearly 60 years it was thought to be extinct. On 8 February 1974, entomologist Wayne C. Gagne of the Bishop Museum and conservationist Mae Mull re-discovered it in the Kī-lau-ea Forest Reserve at about 1700 m elevation. Federal protection was insured in 1978, and in 1979 the Hawaiian vetch was one of four species selected for the U.S. Postal Service endangered species commemorative stamps.

Vicia menziesii is a coarse perennial vine that climb over low vegetation and fallen logs. Its attractive pear-shaped flowers open whitish and darken to a rose color with age. They are 3 cm long and are borne in hanging clusters containing six to nine flowers. The pods, about 10 cm long and 2 cm wide, contain several brownish, round seeds.



Several hundred plants are probably in existence. Feral animals eat the plants and the pods and human activities have already destroyed vast sections of its habitat.

A drug, L-dopa has been isolated from the faba bean, a relative of the Hawaiian vetch. This drug has been useful in treating Parkinson's disease but its presence in the Hawaiian species has not yet been confirmed.

Degener, O. 1932 et seq. *Flora Hawaiiensis.* 7 Vols. Privately published.

McManus, R. E., R. F. Altevogt & B. MacBride. 1978. "Determination that various plant taxa are endangered or threatened species." *Federal Register.* 43 (81): 17910-17916.

BRIGHAMIA CITRINA var. NAPALIENSIS

Ālula
Lobeliaceae

The genus *Brighamia* was described in 1868 by Asa Gray and dedicated to W. T. Brigham, director of the Bishop Museum in Honolulu. An endemic genus, it was originally described as a single species, *B. insignis* with white to cream colored petals, and remained monotypic even though it occurs on Kaua'i, Ni'ihau, Moloka'i and Maui. In 1917 a form with lemon colored petals was described and in 1969 four new taxa were added.

Brighamia grows on steep cliffs usually in windswept coastal areas and is well adapted to this environment. Its horizontal roots are able to penetrate crevasses in the rock face; its thick succulent stems store water and enable the plant to survive periods of drought and the drying effects of constant sea breezes; its leaves diminish in size with diminishing water supply; the base of the plant is rounded to allow slight rocking in the wind.

The steep sea cliffs of the Nā-pali coast on Kaua'i are the home of *Brighamia citrina* var. *napaliensis*. The smooth gray stems of this plant may reach 4 m in height. Its leaves are crowded at the top of the trunk and the flowers, not often seen, appear in small clusters in the axils of the leaves. The long tubular flowers are 8-12 cm in length and lemon yellow in color.

As recently as 1948, *Brighamia* was common along the Nā-pali cliffs. It could be seen and touched without leaving the trail. Today, the plants can be photographed without risking life and limb, only in one area. Rock slides, over-collecting, predation by feral animals and competition from exotic vegetation are serious threats to its survival.

Another *Brighamia* with yellow flowers grows on the south side of Kaua'i. According to some, it is identical to those on the northwest coast. These two plants differ slightly in floral and seed structure.

Rock, J. F. 1919. A Monographic Study of the Hawaiian Species of the Tribe Lobelioideae, Family Campanulaceae. *B. P. Bishop Museum Memoir* Vol. 7 No. 2 394 pp.

St. John, H. 1969. "Monograph of the genus *Brighamia* (Lobeliaceae). Plant Studies 29." *Bot. J. Linn. Soc.* 62: 187-204.

CYANEA SUPERBA

Lobeliaceae

Cyanea superba was first collected by Hillebrand at Makaleha in the Wai-'anae Mountains on O'ahu. It has since been collected 4 more times on O'ahu. Today only two populations are known in the northern Waianaes. Located less than a quarter mile apart, they contain a total of about 40. It was not seen by Rock who stated that it was on the verge of extinction. He believed that *C. superba* was closely related to *C. leptostegia* of Kaua'i, *C. arborea* of Maui and *C. giffardii* of Hawai'i forming with these species a distinct and ancient group which may have been derived from a common ancestor.

Cyanea superba is a beautiful arborescent species that grows to a height of 4-6 m with a trunk that may become 12.5 cm in diameter at the base. Its leaves may grow to a meter in length and its white flowers which appear in late summer occur on long drooping peduncles. Typically, *Cyanea* fruits are classified as berries and somewhat resemble pumpkins about 20 mm long. As is typical of cyaneas, the seedlings of this species possess lobed leaves quite unlike those of the mature plants.

Although located in areas which abound with pigs, these plants appear unharmed by these herbivores. They seem to be reproducting successfully but because of its restricted distribution a single large fire may eliminate both colonies. Overzealous collectors and careless hikers and hunters also represent threats to its survival.

Rock, J. F. 1919. A Monographic Study of the Hawaiian Species of the Tribe Lobelioideae, Family Campanulaceae. *B. P. Bishop Museum Memoir.* Vol. 7 No. 2 394 pp.

CYANEA TRITOMANTHA

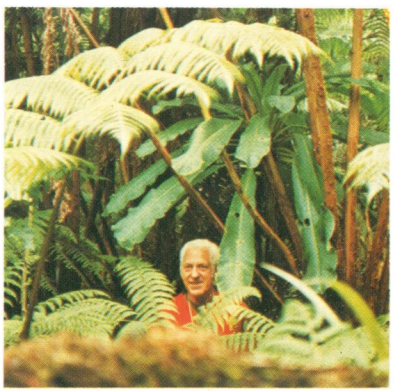
'Akū'akū, 'akū
Lobeliaceae

Cyanea tritomantha, a beautiful but highly variable lobeliad, grows in the rainforests on the windward slopes of Mauna Loa. Like *Cyanea superba* and other arborescent species, it belongs to the section *Palmaeformes*. Its trunk may grow to more than 3 m in height, is rough and knobby and has leaves approaching 1 m in length. Its thick peduncle and petioles are somewhat prickly. Typically, seedlings of the *Palmaeformes* species do not resemble the mature plants. In fact, the eminent American botanist, Asa Gray confused a seedling of *C. leptostegia* for another species belonging to an entirely different section. Seedlings of *C. tritomantha* are spiny. Its deeply divided leaves resemble fern fronds. As the plant matures it loses most of its prickles and the leaves become entire.

The prickles in seedlings of this and other species of lobeliads have been confusing to botanists. The appearance of this plant in its various stages of maturity differs considerably. One prominent botanist suggested that six different species have been described for various stages of *C. tritomantha*.

The Hawaiian people supposedly cooked and ate the large leaves as a vegetable.

Rock, J. F. 1919. A Monographic Study of the Hawaiian Species of the Tribe Lobelioideae, Family Campanulaceae. *B. P. Bishop Museum Memoir*. Vol. 7 No. 2. 394 pp.



ABUTILON MENZIESII

Ko'oloa'ula
Malvaceae

Abutilon menziesii is a hoary shrub with coarsely serrate heart-shaped leaves about 2.5-8 cm long. The attractive flowers are dark red and only 20-25 mm across. Usually they occur singly on long drooping pedicles and hang like Christmas ornaments on a silvery-green tree. Its capsules are narrow, covered with soft hairs, and contain 5-8 cells, each cell containing about three seeds.

The species was named by Berthold Seeman in honor of Archibald Menzies who was a naval officer on George Vancouver's voyages in the Pacific. Menzies was a medical doctor by training but was well-versed in botany and zoology. He made valuable collections also in the Pacific Northwest. The familiar Douglas fir is named in his honor, *Pseudotsuga menziesii.*

Menzies collected this abutilon but the exact locality will never be known. As the early botanists, he merely listed "the Sandwich Islands" as the collection site. Hillebrand knew it from the Waimea side of the Kohala Mountains and his associate Lydgate collected a flesh-colored form on Lā-na'i. More recent collections have been from the highlands in Kona,

Hawai'i, on Lā-na'i, and 'Ewa, O'ahu, where a single plant was discovered near an abandoned sugarcane field in 1978. This plant is thought to be of cultivated origin since *ko'oloa'ula* has been occasionally planted in gardens.

Hillebrand, W. 1965. reprint ed. *Flora of the Hawaiian Islands.* Hafner Publishing Co. New York and London 673 pp.

GOSSYPIUM SANDVICENSE

Ma'o, huluhulu
Malvaceae

The bright yellow flowers of the Hawaiian cotton or *ma'o* adds color to some of the arid coastal plains in Hawai'i. These spreading shrubs approach 1.5 m in height and are chiefly found on the leeward side on all of the major island except Hawai'i. The flowers are 6-8 cm in diameter and its silvery leaves are three to five lobed. As in other gossypiums, the *ma'o* produces cotton bolls but of poor quality. The Hawaiian people apparently never used the brownish, extremely short seed fibers. They are so strongly attached to the seed that it is almost impossible to remove them without breaking. *Ma'o* has become a commercially important species, however, because it has been hybridized with cultivated commercial varieties to produce superior, disease-resistant strains. Its flowers yielded a green dye for Hawaiian *kapa*.

Ma'o is classified as a New World cotton and is the only member of that group not cultivated. The lack of significant ecological and cytogenetic variation between populations on the various islands seem to indicate that it is a relatively recent introduction into the Hawaiian flora. Its seeds, although tolerant of salt water, do not float like other species of *Gossypium*. It may have arrived

in the islands by rafting.

When it was first described in 1865 it was erroneously cited from Fiji also. Although locally common its habitat is being threatened. *Ma'o* usually grows near highways and in areas ideal for urban expansion. Numerous plants are destroyed whenever these highways are widened.

Degener, O. 1932 et seq. *Flora Hawaiiensis.* Fam. 221.

Stephen, S. G. 1963. "Polynesian cottons". *Annals of the Missouri Bot. Gardens.* 50:1-22.

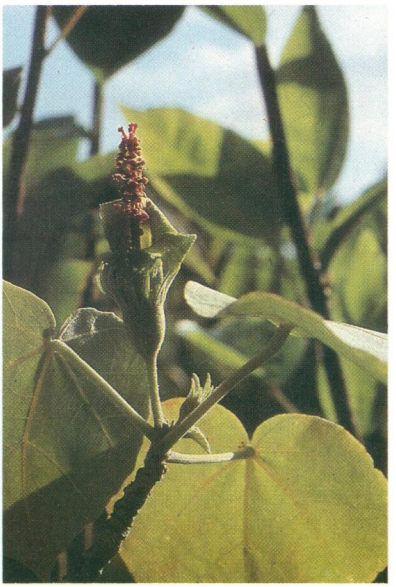
HIBISCADELPHUS DISTANS

Malvaceae

In June 1972, L. Earl Bishop and Derral Herbst discovered this species during a survey of the remnant native forest in Wai-mea Canyon, Kaua'i. Only a small grove of trees are found on a rocky bluff inaccessible to goats. The terrain and its close proximity to a heavily used hiking trail afford some protection from these animals. The plant has been successfully cultivated in botanic gardens.

The flowers of *Hibiscadelphus distans,* 25-30 mm long, are among the smallest of the genus. In contrast, the petals of *H. giffardianus* are between 40 and 65 mm; those of *H. hualalaiensis* are about 25-40 mm long. Upon blooming, the petals are greenish-yellow but turn deep red with age. Abundant nectar can be found at the base of petals. The Kaua'i species also differs from the others in fruit structure, length of the floral bracts and by the absence of hair on the outer surface of the petals. It is a small tree about 5 m in height. Its leaves are about 7-10 cm long, toothed at the margin and hairy on the underside.

Of the five members of the genus *Hibiscadelphus,* three are on Hawai'i and one on Maui. These are the southern-most and youngest of the main Hawaiian Islands. Two



on Hawai'i and the Maui species are probably extinct. *Hibiscadelphus distans* is found on the northern most and oldest of the main islands. Because of its distance both geographically and morphologically from the other species, it was given the specific epithet *distans.*

Bishop, L. E. & D. Herbst. 1973. "A new *Hibiscadelphus* (Malvaceae) from Kauai." *Brittonia* 25: 290-293.

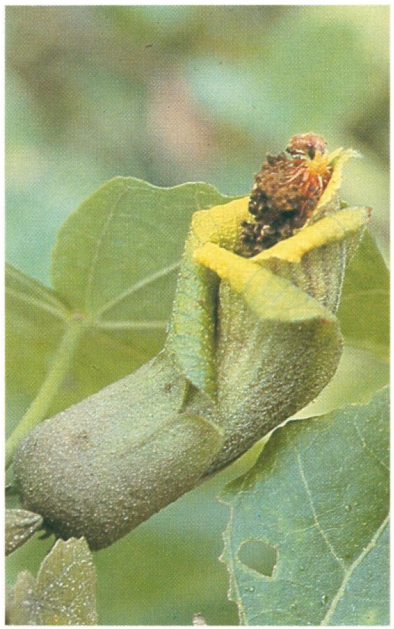
HIBISCADELPHUS HUALALAIENSIS

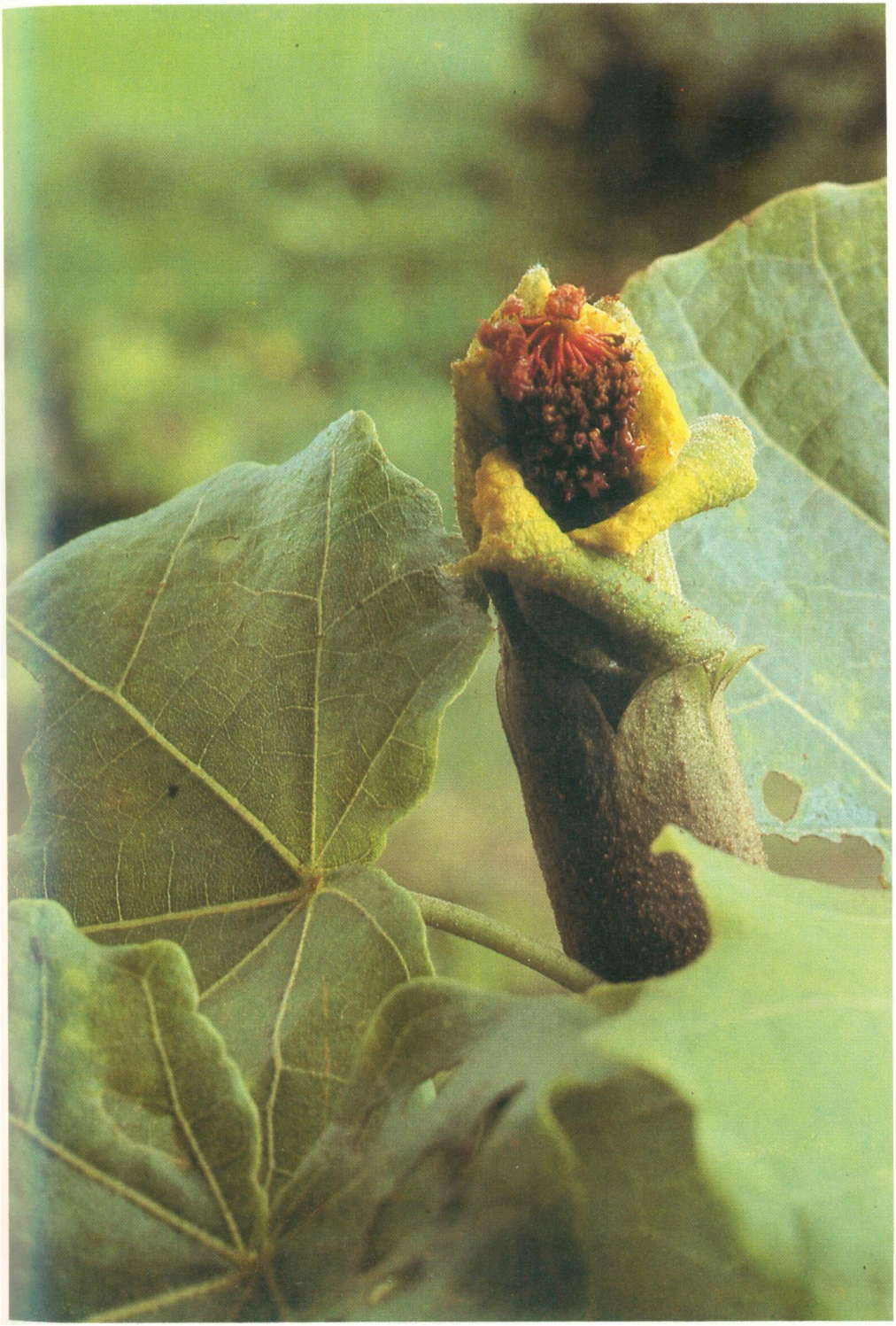
Hau-kuahiwi
Malvaceae

Hibiscadelphus hualalaiensis is a white trunked tree to 7 m in height. Its leaves somewhat resemble those of *Hibiscus tiliaceus (hau)* in shape. The greenish flowers are distinctive as they are curved and appear never to open. This is thought to be an adaptation for pollination by nectar-feeding birds with curved beaks such as the honeycreepers. It was discovered by J. F. Rock in 1909 on the lava fields of Hualālai in North Kona, Hawai'i. Two years later he named that species after the mountain on which it grows. In 1913 there were at least a dozen trees in existence but Rock noted that the leaves and seed capsules were being attacked by moth larvae. Today only two wild trees are known to exist. The demise of this plant is almost a certainty since no seedlings have every been observed. Despite being damaged by insects, these two trees produce a fair amount of viable seeds. Many botanical gardens have successfully grown seedlings to flowering stage. It is extremely doubtful that the two trees would ever produce wild offspring. Large caches of damaged seed coats at the bases of the trees indicate predation by rats. Seeds that escape the rats are unable to germinate through the thick carpet of pasture grass. Although both trees are surrounded by fences by the concerned landowner, the fences are in disrepair and cattle are often able to breach the enclosures. Thus although it will be saved by cultivation, it will someday disappear from its natural habitat.

Degener, O. 1932 et seq. *Flora Hawaiiensis.* Fam. 221.

Rock, J. F. 1913. *The Indigenous Trees of the Hawaiian Islands.* Published under patronage. 518 pp.





HIBISCUS BRACKENRIDGEI

Malvaceae

One of the few spectacular flowers in the Hawaiian flora belongs to this hibiscus of the dry regions. First collected on West Maui by the United States Exploring Expedition, it was named by Asa Gray for Joseph D. Brackenridge, botanist on the expedition.

When the Hawaiian members of the genus were monographed in 1960, four varieties were known. The typical variety which was collected by the U. S. expedition comes from Maui and Lā-na'i. Only two wild plants remain in Lā-na'i. Fortunately it has been cultivated and planted along the main highway on the island. It is an upright shrub with leaves having 5-7 deep lobes and flowers with petals 4-5 cm long. Variety *molokaiana* was discovered by Joseph Rock on West Moloka'i in 1910 and is a rambling shrub with slightly larger flowers. Another rambling shrub is the var. *kauaiana* which was

described by Edward Caum from Kaua'i. Sister Margaret James Roe described var. *mokuleiana*, a tree 10-12 m tall with petals 8-10 cm long from the Wai-'anae Mountains near Mokulē'ia, O'ahu. Today, var. *molokaiana* is considered extinct and only one colony of a few plants is known of var. *mokuleiana*.

Variety *kauaiana* was re-named *Hibiscus rockii* in 1962 and it is now suspected to be an introduced African species closely related to *H. brackenridgei*. Recently another variety was discovered in the North Kona district of Hawai'i. There are less than 10 plants of this undescribed variety.

Attempts have been made to cultivate the varieties of *H. brackenridgei*. The Wai-mea Arboretum has successfully propogated the Lā-na'i, O'ahu and Hawai'i ones.

Roe, M. J. 1960. "A taxonomic study of the indigenous Hawaiian species of the genus *Hibiscus* (Malvaceae)." *Pac. Sci.* 15:3-32

HIBISCUS CLAYI

Malvaceae

The Clay hibiscus is a small shrubby columnar tree reaching 3 m in height. Its stiff, shiny, dark green leaves are about 5 cm long and about 2 cm wide, occuring mostly at the tips of branchlets. Unlike the Brackenridge hibiscus, the petals of this species are narrow, measuring about 4.5 cm long, 7 mm wide at its base and 11 mm wide at the tip.

This attractive species was discovered in 1928 by Albert Duvel at about 200 m elevation near Ha'i-ku, Kaua'i in an area badly damaged by cattle. Duvel cultivated this species at the Territorial Board of Forestry and Agriculture nursery near Līhue. Later, others planted it in their own gardens. The type specimen (from which an original plant description is made) is a cultivated plant which grew in the City and County Hibiscus Garden near Ka-pi'o-lani Park in Honolulu. It was a seedling from one of Duvel's cultivated plants which originated as cuttings from the wild plants.

In 1959 it was named by Otto and Isa Degener in honor of Dr. Horace Clay, an eminent horticulturist and instructor at Leeward Community College.

Degener, O. 1932 et seq. *Flora Hawaiiensis.* Fam. 221.

HIBISCUS SAINTJOHNIANUS

Malvaceae

Hibiscus saintjohnianus is another endemic growing along the Nā-Pali coast of Kaua'i. This tall columnar-shaped shrub or small tree grows on the precipitous slopes which are inaccessible to feral animals. Several trees can be seen near the Ka-lalau Trail and although a few may be within reach, most are on dangerous cliffs.

The plant may grow to 6 m in height with a trunk 8 cm at the base. Its leaves are 6-12 cm long, shiny green, with serrations along the margin. Although not very large, perhaps 10 cm in diameter, its flowers are extremely attractive. The heavy-textured petals vary in color from bright orange to dark red-orange.

Unlike *H. brackenridgei*, which has not been as extensively cultivated, this species has been brought into cultivation on numerous occasions. The Reverend John M. Lydgate, who as a youth collected with Hillebrand was said to have planted some in his yard on Kaua'i. More recently Dr. Harold St. John and Sister Margaret James Roe also popularized its cultivation and various local botanical gardens have propagated it for distribution.

First discovered by Charles N. Forbes in 1913, this species was named in honor of Dr. Harold St. John of the Bishop Museum, one of the foremost authorities on Hawaiian flora.

Roe, M. J. 1960. "A taxonomic study of the indigenous Hawaiian species of the genus *Hibiscus* (Malvaceae)." *Pac. Sci.* 15:3-32.

KOKIA DRYNARIOIDES

Koki'o, Hau-hele-'ula
Malvaceae

During Cook's third voyage David Nelson recorded a plant, which was later named *Gossipium drynarioides* by Berthold Seeman in 1865. It was thought that Nelson's fragmentary samples came from Moloka'i. It could only have come from Hawai'i, however, as it was the only island on which he landed. Later, Hillebrand obtained a specimen from Moloka'i, confused it with Nelson's collection and amplified Seeman's description not realizing that he had a completely new species.

The flowers are 20 m across, thick-petaled, scarlet in color, and are spectacularly beautiful. Its leaves resemble those of maples in shape as well as in autumn colors. They occur at branchlet tips. Often, the trees reach heights of 6 m.

When Rock first observed it in June, 1909 he considered it extremely rare. In 1930, Degener estimated the total population in North Kona at 200 trees. Today fewer than 20 are known. Its habitat has been destroyed by feral animals. Cattle and pigs have eaten every seedling which may have sprouted through the thick pasture grasses. As in the *Hibiscadelphus* from that region, the *Kokia* will probably become extinct as a wild species. Fortunately seeds have been distributed to numerous botanical gardens and through the efforts of early foresters such as L. W. Bryan, several mature cultivated trees can be seen along Māmalahoa Highway in North Kona.

In the early days, the bark was stripped off the trees and macerated. Dye was obtained to color fish nets. A government regulation was passed to end this practice. The plant was called *hau-hele-'ula* and *koki'o* by the early Hawaiians.

Degener, O. 1930. *Ferns and Flowering Plants of Hawaii National Park.* Honolulu Star Bulletin, Ltd. Honolulu. 313 pp.

Rock, J. F. 1913. *The Indigenous Trees of the Hawaiian Islands.* Published under patronage. 518 pp.

PORTULACA HAWAIIENSIS

Portulacaceae

Dr. Otto Degener first discovered this species in 1929-1930 along the arid shoreline at South Point, Hawai'i and nearby at Wai-'ōhinu. Seven years later he described it as a new species.

Portulaca hawaiiensis is a succulent perennial herb with a thick taproot and fleshy, dull grayish-green leaves varying in length from 5-15 mm. Its delicate flower petals are pink at the edges, white towards the center and about 2 cm in diameter. Its stamens number about 30 surrounding the pink ovary. Seeds are shiny and dark mahogany in color.

This Hawai'i portulaca has also been collected at Ka-moamoa in the Puna district but may now be extinct there as well as in Wai-'ōhinu. Although it is scattered all along the coast of the Ka'ū desert, a portion of its range is open pasture. Cattle will eat these succulents down to the ground. During droughts these plants rely on their fleshy tap roots to sustain them until the next rains only to again be eaten by foraging cattle. During drought cattle will even forage among formidable rock piles in search of these plants.

Degener, O. 1932 et seq. *Flora Hawaiiensis. Fam. 117.*

PORTULACA SCLEROCARPA

'Ihi-mākole, po'e
Portulacaceae

Another rare endemic portulaca is *P. sclerocarpa.* Like *P. hawaiiensis,* it has fleshy tuberous roots and succulent leaves. Its flowers are cream-colored sometimes tinged with purple but not as large as *P. hawaiiensis.* They bloom in the morning, close in the afternoon and will not open on cloudy days. Its capsular fruits contain numerous shiny mahogany brown seeds 5-6 mm long. The top portion of the capsule of other Hawaiian portulacas falls off like a lid when mature but those of *P. sclerocarpa* do not.

The species is found on Maui, Hawai'i, Ka-ho'olawe and Molokini. On Hawai'i it grows in the Puna, Kī-lau-ea and Kona regions and in the central plateau between Mauna Kea and Mauna Loa. It is usually associated with cinder and lava fields in arid areas. Some of the known populations are in volcanically active regions. Massive lava flows could drastically reduce its numbers. *'Ihi-mākole* was first collected by the United States Exploring Expedition.

There is controversy about the names of our native portulacas. Geesink suggests that most of them should be regarded as subspecies of the widely distributed *P. pilosa.* Experiments showed that *P. pilosa* can tolerate a wide range of environmental conditions. Others disagree, saying that the Hawaiian plants differ significantly from the identifying features of *P. pilosa.*

Stone, B. C. 1963. "The genus *Portulaca* in the Hawaiian Islands." *Advancing Frontiers of Plant Sciences.* 14:141-149.

ALPHITONIA PONDEROSA

Kauila, Kauwila, nīoi
Rhamnaceae

Alphitonia ponderosa has been reported from the drier regions on all the major islands. So few trees remain on Lā-na'i and Moloka'i that it may some day disappear from those islands. It is almost extinct on O'ahu and Maui where its habitat has been destroyed by cattle. On Hawai'i it still survives in the cattle country of Ka'ū and North and South Kona. On Kaua'i, the only island where it can be readily seen, it grows in the Kōke'e region where it is reputed to be the tallest tree.

Alphitonia is a tall tree, reaching heights of 25-30 m, with lance-shaped leaves and flowers less than 5 mm across. Its wood is hard, durable, close-grained and reddish with dark streaks. It was used by the early Hawaiians for spears, tools and tapa beaters. The wood sinks in water and blackens with age.

The native *Alphitonia* differs from another hard-wooded tree of the same family *Colubrina oppositifolia*. Its twigs and lower leaf surface are covered with rust-colored hair whereas those of *Colubrina* are not. Both have woody fruits but those of *Alphitonia* are smooth and those of *Colubrina* are 3-grooved. Both trees are called *kauila* and *kauwila*.

Degener, O. 1930. *Ferns and Flowering Plants of Hawaii National Park.* Honolulu Star Bulletin, Ltd. Honolulu. 313 pp.

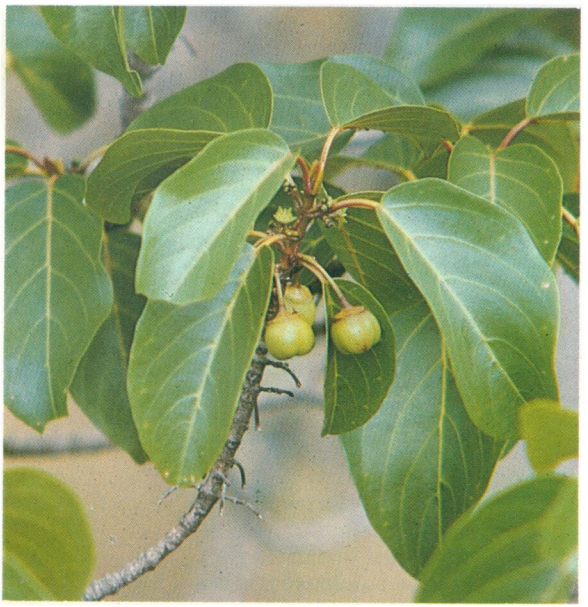
Hillebrand, W. 1965. reprint ed. *Flora of the Hawaiian Islands.* Hafner Publishing Co. New York and London. 673 pp.

Rock, J. F. 1913. *The Indigenous Trees of the Hawaiian Islands.* Published under patronage. 518 pp.

COLUBRINA OPPOSITIFOLIA

Kauila, Kauwila
Rhamnaceae

Colubrina oppositifolia is a tree that grows to 10-12 m with light, scaly bark. The wood is extremely hard, durable, close-grained, and dark red in color. Used by early Hawaiians for spears and tapa beaters, it is considered one of the hardest of all native woods. The opposite leaves are 12 cm long and 5 cm wide. They are bright green on both surfaces. A prominent feature is a gland found at the base of each vein on the underside of the leaves. The inconspicuous, star-shaped flowers are yellowish-green and about 6 mm in diameter.



The fruits of other Pacific colubrinas float in sea water. Likewise, the ancestor of *C. oppositifolia* probably arrived by floatation. In time, this ancestral species lost its dispersal mechanism. Our *Colubrina* has fruits that sink. The fruits are woody, 3-sectioned capsules 12 mm in diameter.

The distribution of *Colubrina oppositifolia* is unusual. It is found only in the dry forests of O'ahu, one of the oldest of the major islands and at the opposite end on Hawai'i, the youngest island. On O'ahu it is nearly extinct. On Hawai'i, it can only be found on the west side. In 1913, Rock considered it extremely rare in South Kona but common in North Kona. Sadly, cattle and feral animals have wrought nearly total devastation on the environments in these areas and today *Colubrina oppositifolia* is almost extinct. Many old trees still exist, but as very few seedlings have been reported, this species is probably doomed to extinction.

Degener, O. 1930. *Ferns and Flowering Plants of Hawaii National Park.* Honolulu Star Bulletin, Ltd. Honolulu. 313 pp.

Degener, O. 1932 et seq. *Flora Hawaiiensis.* Family 215.

Rock, J. F. 1913. *The Indigenous Trees of the Hawaiian Islands.* Published under patronage. 518 pp.

GOUANIA HILLEBRANDI

Rhamnaceae

When Hillebrand wrote his *Flora*, four species of *Gouania* were known in the islands. The first one described was collected on O'ahu in June, 1831 by Franz Julius Ferdinand Meyen, surgeon and botanist on the world voyage of the Prussian ship "Prinzess Louise". A second species was collected by the United States Exploring Expedition in 1840 on O'ahu. Hillebrand added two – one named after him by the English botanist Oliver.

Gouania hillebrandi is a shrub growing to 2 m in height. Its twigs bear small brownish hairs and its leaves, nearly 6 cm long, are pale olive green on the upper surface and slightly hairy on the lower. It has fragrant, star-shaped flowers less than 10 mm wide and fruits that are three-winged.

Hillebrand discovered this species in the gulches behind Lahaina in August, 1870. Before its rediscovery in December, 1955 by Dr. Harold St. John, it was recorded only twice since Hillebrand's time. This *Gouania* is restricted to a trachyte (light colored rock) formation on the western slopes of the West Maui Mountains. In 1955 St. John estimated that it comprised about 25% of the vegetation in the area. The shrubs were up to 1.5 m tall. Three years later, most of the plants were less than a meter in height and consisted of a single stem. The population was greatly diminished. Traced over several ridges, about 520 plants were counted. In 1978 only 20 were seen among the main population. The entire region is being grazed by cattle. In 1979, another colony, consisting of several hundred, was discovered on West Maui in an area free from cattle. If kept free of herbivores, this species will continue to survive.

Most of the native *Gouania* inhabit dry forests that have been decimated by cattle. As a result, 11 of the 15 species have not been seen since 1886 and are almost certainly extinct.

St. John, H. 1969. "Monograph of the Hawaiian species of *Gouania* (Rhamnaceae). Hawaiian Plant Studies 34." *Pac. Sci* 23:507-543.

MORINDA SANDWICENSIS

Noni-kuahiwi
Rubiaceae

Morinda sandwicensis is a tree 10 m in height with spreading branches. Its leaves are elliptic in shape, shiny dark green and about 13-18 cm long. Like many members of the coffee family, it has prominent stipules that form sheaths around the stems. From a distance, *Morinda sandwicensis* looks like other trees. Upon closer examination, the stipules indicate its family relationship but its inflorescence and fruit are distinctive. Like its lowland relative *Morinda citrifolia (noni),* its flowers occur in clusters at the ends of axillary peduncles about 5-15 mm long, often on the older part of branches. About 11 light-green flowers are so closely arranged that the maturing ovaries become united into a large, collective fruit.

Otto Degener and two associates discovered this species in a dense moist forest on the lee side of the Wai-'anae Mountains near Mākua Valley in 1932. Since then numerous collections were made on both the leeward and windward slopes in the northern portion of the Wai-'anae range. This tree may not be as rare as once imagined.

The migrating Polynesians brought *Morinda citrifolia,* an important medicinal plant, to Hawai'i. They must have recognized the close relationship between their familiar *noni* and *M. sandwicensis.* The O'ahu endemic is called *noni-kuahiwi* or "mountain *noni*". No uses have been reported for *noni-kuahiwi.*

Degener, O. 1932 et seq. *Flora Hawaiiensis.* Family 332.

SANTALUM ELLIPTICUM

'Ili-ahi-a-lo'e
Santalaceae

Contrary to popular belief, the native sandalwoods have not been logged out to near-extinction because of their fragrant wood. Several species are still common. The Hawaiian sandalwoods have been divided into two species groups: those with long, tubular flowers that are dark red and those with smaller, funnel-shaped flowers that are yellowish green. *Santalum ellipticum,* belonging to the latter group, has been taxonomically confused for many years. It is such a diverse complex that since the days of Hillebrand, botanists have tried to split it into several different species and varieties. No less than 14 different names have been applied to plants belonging to this species.

This lowland sandalwood can be found on most of the major islands, in bogs, wet forests and dry forests, on lava deserts, salt-sprayed sea coasts, sand dunes, limestone formations, on adobe soils and even at one time on the coral atoll of Laysan. *'Ili-ahi-a-lo'e,* the coastal form, is a low shrub, sometimes with long branches and usually having thicker leaves than the mountain forms, an adaptation for water conservation. The upland forms are upright shrubs or small trees 3 m tall. Depending on the variety, the flowers are 4-7 mm long. They lack true petals and the four greenish-yellow petal-like structures are actually modified sepals.

The bark of *Santalum ellipticum* was pounded and applied as a remedy for lice infestation and the powdered heartwood used to scent tapa.

The coastal sandalwood is considered endangered because with increased shoreline development, its habitats are being destroyed.

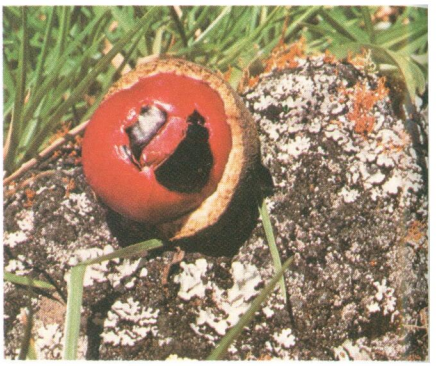
Degener, O. 1932 et seq. *Flora Hawaiiensis.* Fam. 100.

ALECTRYON MACROCOCCUM

Māhoe, 'Ala-ala-hua
Sapindaceae

Alectryon macrococcum is a medium sized tree 7-10 m tall. Its trunk is brown and its wood is dark yellowish-brown and very hard. Leaves are pinnately compound with two to four leaflets and branchlets, flower clusters and undersides of leaves are covered with dense brown hair. The fruits are often in pairs thus the derivation of its Hawaiian name *māhoe* which means "twins". When mature, the fruit ruptures, revealing the glossy chestnut brown seed within which is surrounded with a scarlet edible aril. The seeds are 3-4 cm in diameter and the kernels were also eaten by the Hawaiians. Its inconspicuous flowers lack petals and bloom during the summer.

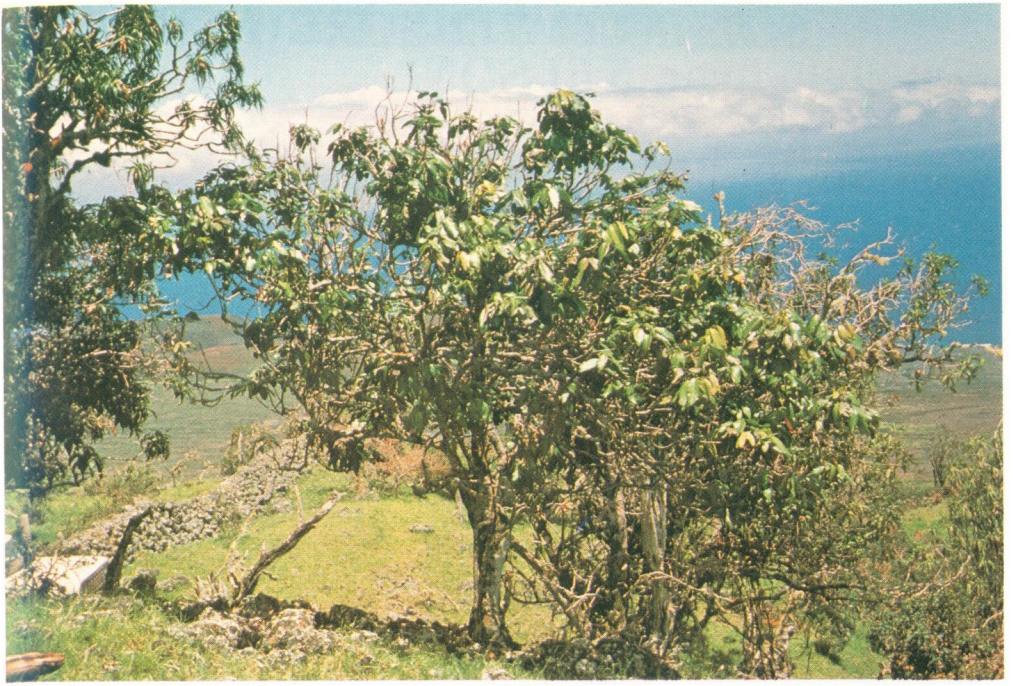
This rare species has been recorded from the dry regions of Kaua'i, Moloka'i and Maui. In June 1972, Drs. Derral Herbst and L. E. Bishop discovered a single tree in a branch of Wai-mea Canyon in Kaua'i, the first sighting on that island since early this century. On Moloka'i only two dying trees were known in 1928.

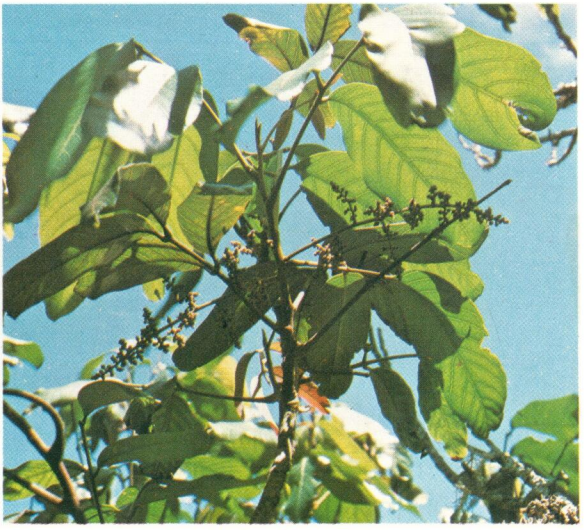


Joseph Rock found about 40 trees in the rich forest of Auwahi on the south slopes of Hale-a-ka-lā in 1910. Since then this area has been destroyed by cattle, and today only two are known. The seeds have a difficult time germinating through the dense pasture grass. Those that do are eaten by cattle.

Degener, O. 1932 et seq. *Flora Hawaiiensis.* Fam. 210.

Rock. J. F. 1913. *The Indigenous Trees of the Hawaiian Islands.* Published under patronage. 518 pp.





SOLANUM NELSONI var. NELSONI

Solanceae

Solanum nelsoni var. *nelsoni* is a low, trailing shrub with soft, golden, star-shaped hairs. Its thick leaves have margins that are smooth, wavy or slightly lobed and bases that are tapered or rounded. Its flowers are about 6 mm in diameter and somewhat resemble those of its relatives, the tomato and egg-plant. Fruits are red or black in color, 4-5 mm in diameter and resemble miniature tomatoes.

The species is named for David Nelson who supposedly collected it in 1778 on an unspecified island in the Hawaiian chain. Nelson, however, got ashore for only 5 days at Ke-ala-ke-kua, Hawai'i in 1779 so the plant was evidently collected on that island. Today, it inhabits the arid coasts of Maui, Ni'ihau, Moloka'i it is occasionally seen growing in sand along with

Sporobolus virginicus, Sida fallax and *Heliotropium anomalum* var. *argenteum* some distance behind the beach. Although found on several islands, it is extremely restricted in distribution.

Hillebrand, W. 1965 reprint ed. *Flora of the Hawaiian Islands.* Hafner Publishing Co. New Yrok and London. 673 pp.

ISODENDRION HOSAKAE

Violaceae

Isodendrion is an endemic genus of woody shrubs described by Asa Gray in 1852 based on three new species collected on O'ahu by the United States Exploring Expedition. One new species was added in 1897 and 10 in 1952 by Harold St. John. In 1978 another was described by St. John. The species of *Isodendrion* have always been extremely rare. Today of the 15 species, nine are thought to be extinct.

Isodendrion hosakae is a small shrub 45-75 cm tall with hairy branchlets and small leaves 2.6 cm long, dark green above and whitish hairy below. Its small pale yellow flowers are slightly fragrant and occur singly in leaf axils. It was discovered by Edward Hosaka on November 4, 1948 on a cinder cone in the South Kohala District on Hawai'i. Three months later he returned to document it further. In 1952 St. John named it after Hosaka, his former student.

For 30 years it was not seen again. Then at dusk on January 13, 1980, Dr. Carolyn Corn, the Hawaii State Botanist, discovered it on a cinder cone in South Kohala. Only about 300 small plants are found on this and a neighboring cinder cone. The areas are steep and rocky, inaccessible to cattle that graze through the region.

St. John, H. 1952. "Monograph of the genus *Isodendrion* (Violaceae). Hawaiian Plant Studies 21." *Pac. Sci.* 6:213-255.

ISODENDRION MACULATUM

Aupaka
Violaceae

Isodendrion maculatum is a woody shrub to 2 m tall with longitudinal fissures on the older branches. The leaves vary from 6-22 cm long and 18-77 mm wide, dark green on the upper surface and pale green on the lower. The flowers occur singly on pedicles of 1 mm length. On the young stems flowers are in the leaf axils but on older stems they occur on short thick knobs. The flowers are purple, less tubular in shape than those of *I. hosakae* and about 7-10 mm long.

This species is native to Kaua'i where it grows in a narrow valley on the Nā-pali Coast and in the mountains on the southwest section of the island. It is one of four species found on that island. Among the three oldest of the major islands, Kaua'i, O'ahu and Ni'ihau, 11 of the 15 species of *Isodendrion* have been found. Unlike most of the other species, *I. maculatum* inhabits the moist woods.

The Hawaiian name *aupaka* is attributed to Hillebrand. The plant has been recorded twice in this century, once in 1931 by St. John and again in 1970 when seeds and cuttings were distributed to botanic gardens.

Most *Isodendrion* are lowland species of the dry regions where their habitats have been largely destroyed by goats and cattle.

St. John, H. 1952. "Monograph of the genus *Isodendrion* (Violaceae). Hawaiian Plant Studies 21." *Pac. Sci.* 6:213-255.

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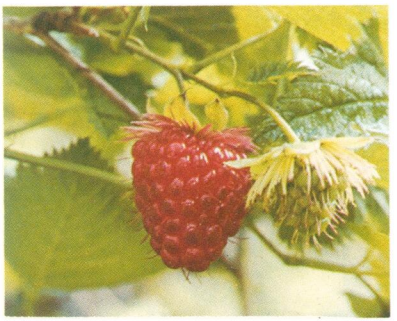
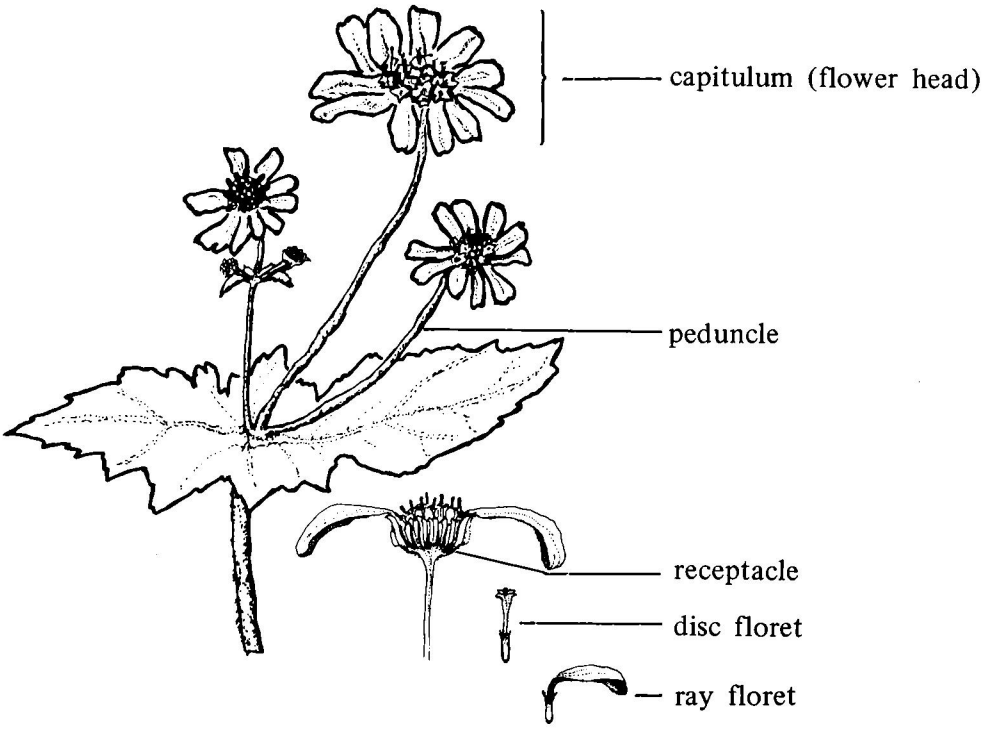


Rubus hawaiiensis. Wai-ka-moi, Maui

ILLUSTRATED GLOSSARY



APPROXIMATE METRIC CONVERSIONS

TO CONVERT	INTO	MULTIPLY BY
millimeters (mm)	inches (in)	0.04
centimeters (cm)	inches (in)	0.4
meters (m)	inches (in)	39
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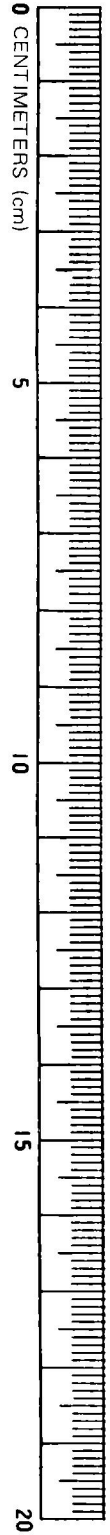

Cover: *Hesperomannia arbuscula* subsp. *oahuensis*
Inside cover: *Argyroxiphium sandwicense*
Title page: *Haplostachys haplostachya* var. *angustifolia*